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EVAPORATION RATES OF CHEMICAL WARFARE AGENTS USING 5 CM WIND TUNNELS
V. VX FROM SAND AND CONCRETE

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The evaporation of VX from sand and concrete was studied as a function of temperature, drop size and air flow rate. One sand substrate and five carefully controlled concrete compositions were used in this study. For VX on sand and concrete, an equation was determined for each substrate that would allow for the calculation of the evaporation rate given the temperature, drop size, air flow rate and %vapor recovered. In addition, one curve was generated for VX on glass, sand and concrete. The VX evaporation rate data were also compared to evaporation rates of H, HD, GD and thickened GD on glass, stainless steel, sand and concrete; one regression line with $r^2 = 0.90$ for the $\log_{10}$(evaporation rate) was generated by using all of these agent/substrate combinations; the evaporation rates were segregated by agent, but not by substrate. A regression line for the time taken to reach a vapor concentration of 0.003 mg/m^3, which is the Short Term Exposure Limit for sulfur mustard and the Immediately Dangerous to Life and Health Limit for VX given the temperature, drop size, air flow rate and substrate, was generated.

15. SUBJECT TERMS

VX	Sand	Silica sand	UK sand
Concrete	CZ04	Evaporation rate	Wind tunnel

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PREFACE

The work described in this report was authorized under Contract No. DAAD13-03-D-0017 and Project No. BA07TAS041. The work was started in August 2006 and completed in November 2009.

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EVAPORATION RATES OF CHEMICAL WARFARE AGENTS USING 5 CM WIND TUNNELS V. VX FROM SAND AND CONCRETE

1. INTRODUCTION

Knowledge of the concentration of VX vapor in the air is important for determining which type of personal protective equipment is most appropriate for a given situation. In this report, the vapor concentrations as a function of time and the evaporation rates of VX from sand and concrete as a function of temperature, drop size and air flow rate were measured in 5 cm wind tunnels. Select evaporation and degradation rates of ton container VX on sand and glass[1] have been previously reported in the literature.[2] The instrumentation used was the same as that for the studies of VX evaporation from glass, and the experiments were performed within the same timeframe. The glass,[3] sand[4,5] and concrete[6,7] substrates and instrumentation were the same as those used in previous studies of sulfur mustard, although additional concrete samples were used. The additional concrete samples were made with different water-to-cement ratios, which in turn should affect the physical properties (porosity, surface area, pore diameter) of the concrete, which in turn may affect the evaporation rate.[8]

This report contains a cursory data analysis and describes the robustness of the set of data that will be passed to the modelers for eventual incorporation into field models such as VLSTRACK and JEM.

2. EXPERIMENTAL PROCEDURES

The instrumentation and techniques used were the same as those described in the VX on glass studies. The sand used was the same as that used in the VX on sand studies,[2] and the concrete used was described in the sulfur mustard on concrete studies.[6] Additional laboratory-made samples of concrete that had water-to-cement (w/c) ratios of 0.35, 0.45 and 0.50 were used. The top finish for all the samples was a 'brushed' finish; an additional 'smooth' finish was provided for the 0.45 sample. The physical properties of the samples were measured using mercury intrusion porosimetry (details in Appendixes C-E). All of the samples looked the same as the CZ04, which had a w/c ratio of 0.45. The CZ04 was made on an industrial scale in a different location from the other samples, which were made on the laboratory scale.

It was possible for a droplet of VX to fall from the pipette onto the sand and concrete; but, due to the small mass of the droplet on a much larger mass of sand and concrete, it was not possible to get an accurate reading of the weight of the droplet. Thus, all agent masses are nominal values based upon the pipette settings and the purity of the agent.

3. RESULTS

3.1 Sand.

3.1.1 Evaporation Rates.

The data collected in the experiments were evaporation profiles of the VX vapor concentration (mg/m^3) as a function of time (Figure 1). The VX vapor was collected until the concentration of agent reached an approximate plateau, often ~1 x 10^{-4} mg/m^3, which was about 1000 to 4000 min for most samples. Plots for all of the data collected are in Appendix A. At 50 °C, all of the agent had evaporated by 1000 min; whereas, at 35 °C, the evaporation was not complete until 4000 min. Plots of replicate collections of evaporation data at two different conditions demonstrate the degree of variability observed (Figure 1). The vapor concentrations of VX were above the Immediately Dangerous to Life and Health (IDLH) value of 0.003 mg/m^3 for several hours; the vapor concentrations had a higher peak value for the 50 °C samples, but the 35 °C samples were above IDLH for a longer period of time, approximately 40 h for one sample.

Distribution plots of %VX vapor recovered and %VX extracted from the sand after evaporation showed averages of 16 and 10%, respectively, although the data exhibited high variability (Figure 2, Table 1). A cube plot shows the ranges in %VX vapor recovery as a function of the environmental parameters temperature, drop mass and wind speed (Figure 3). The cube plot is shown in terms of the wind speed, an operationally relevant number, rather than the air flow rate of the tunnel. The tunnel was calibrated and the wind speeds measured at various flow rates at 1 cm above the tunnel floor.[9] The percentage of agent recovered was largely random; the least squares regression had a low correlation coefficient ($r^2 = 0.33$). Thus, on average, 74% of the VX was neither evaporated nor extracted.

The evaporation rate was calculated by summing the %VX vapor recovered, plotting the cumulative %VX loss versus time, and taking the slope of the line, which was the evaporation rate (Figure 4). The data used for calculating the evaporation rate was collected a few minutes after the sample was inserted into the wind tunnel; the data were chosen from the beginning of the evaporation curve, such that r^2 was >0.98. Examples of replicate plots of cumulative %VX versus time at two different conditions demonstrate the degree of variability observed in the experiments (Figure 5). A cube plot that summarizes the evaporation rates is shown in Figure 6.

Scatterplots of the variables' substrates temperature (°C), droplet mass (mg), and air flow (SLPM), and the results of %VX vapor recovered and the evaporation rate (µg/min) showed that the %VX vapor recovered and the evaporation rate (µg/min) were loosely correlated with each other ($r = 0.86$,[†] Figure 7). None of the other parameters were correlated. In fact, the data showed that the %VX vapor recovered and evaporation rate data were distributed throughout their respective ranges as a function of temperature, drop mass and air flow. Because

† r is the Pearson Product-Moment correlation; a perfect fit is r = 1.0. JMP Statistics and Graphics Guide, Version 5, SAS Institute, Cary, NC, 2002, p 376.

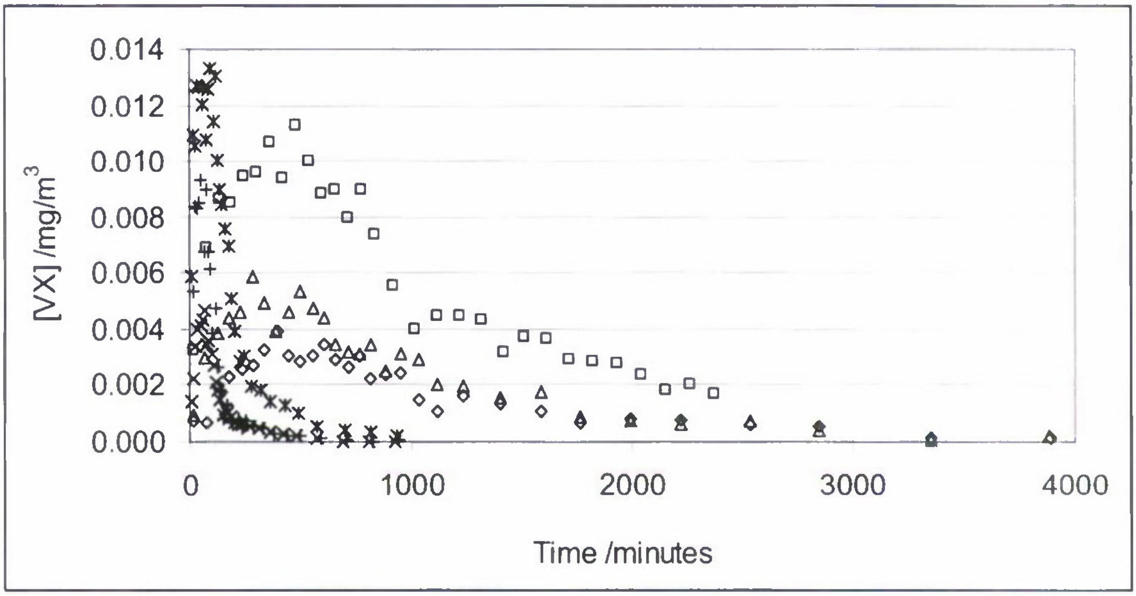
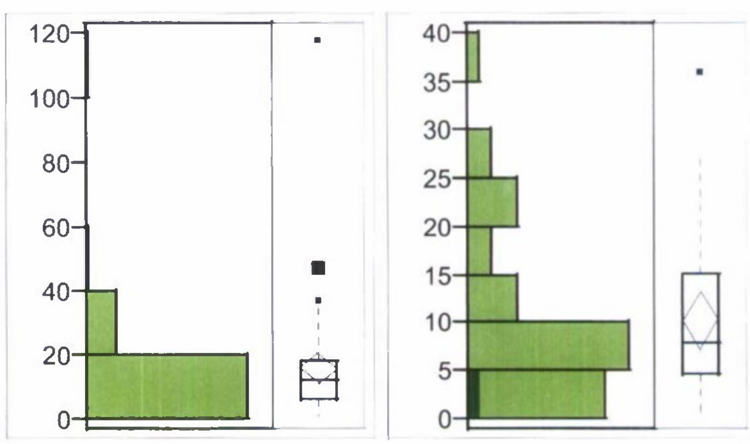


Figure 1. Vapor concentrations for 1 µL droplets of VX evaporating from sand at 35 °C, 18 SLPM (△,□,◇) and 50 °C, 405 SLPM (+,✱,×).



a b

Figure 2. Distributions for (a) %VX vapor collected and (b) %VX extracted from sand after evaporation.

Table 1. Distributions for %VX Vapor Collected and %VX Extracted from Sand after Evaporation

	% VX vapor collected	%VX Extracted
Mean	16.0	10.0
Std Dev	17.0	9.0
Std Err Mean	2.4	1.4
Upper 95% Mean	21.0	13.0
Lower 95% Mean	11.0	7.0
N	51.0	37.0

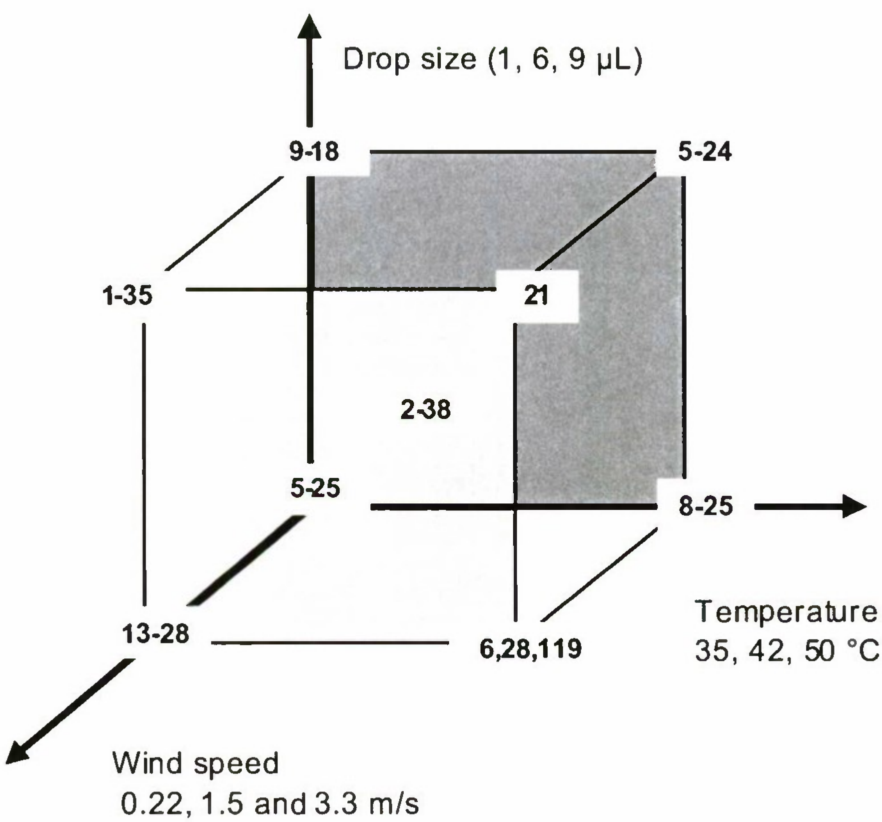


Figure 3. Cube plot of %VX vapor recovered for evaporation of VX from sand.

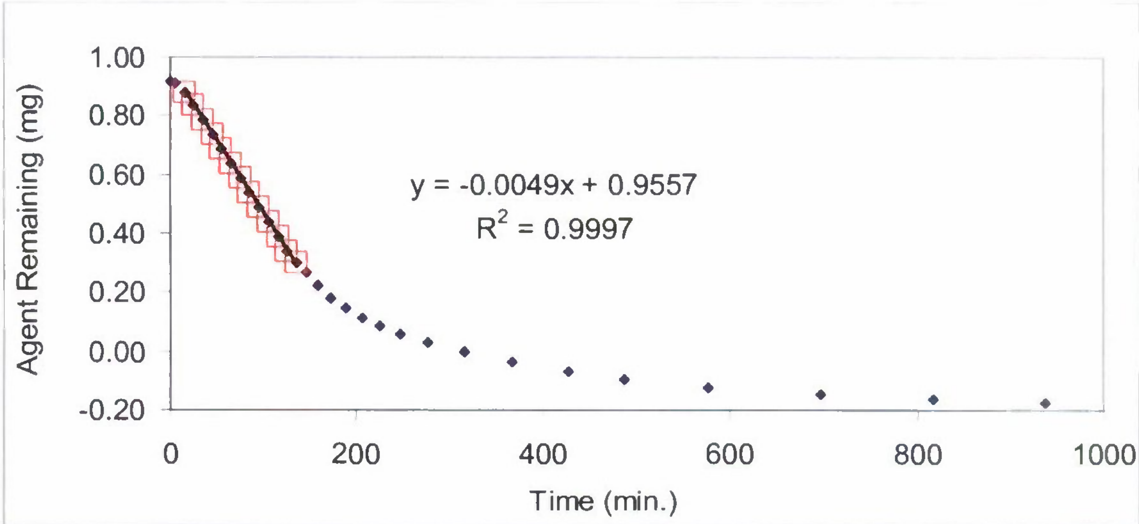


Figure 4. Agent remaining (mg) for 1 μL droplets of VX evaporating from sand at 50 °C, 405 SLPM showing the calculation of the initial evaporation rate (mg/min).

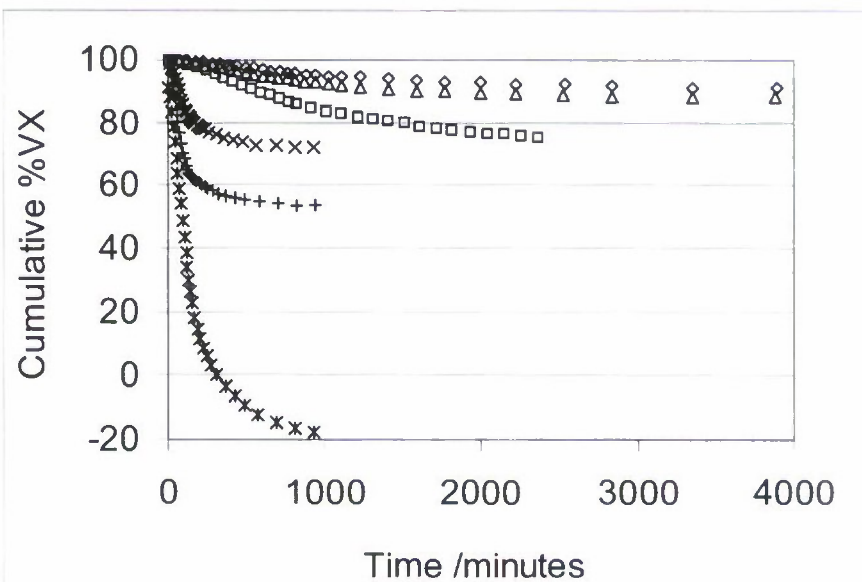


Figure 5. Cumulative VX vapor recovered for 1 μL droplets of VX evaporating from sand at 35 °C, 18 SLPM (△,□,◇) and 50 °C, 405 SLPM (×,+,∗). The solid line represents the degradation rate of VX at 50 °C, and the dashed line represents the degradation rate of VX at 35 °C.

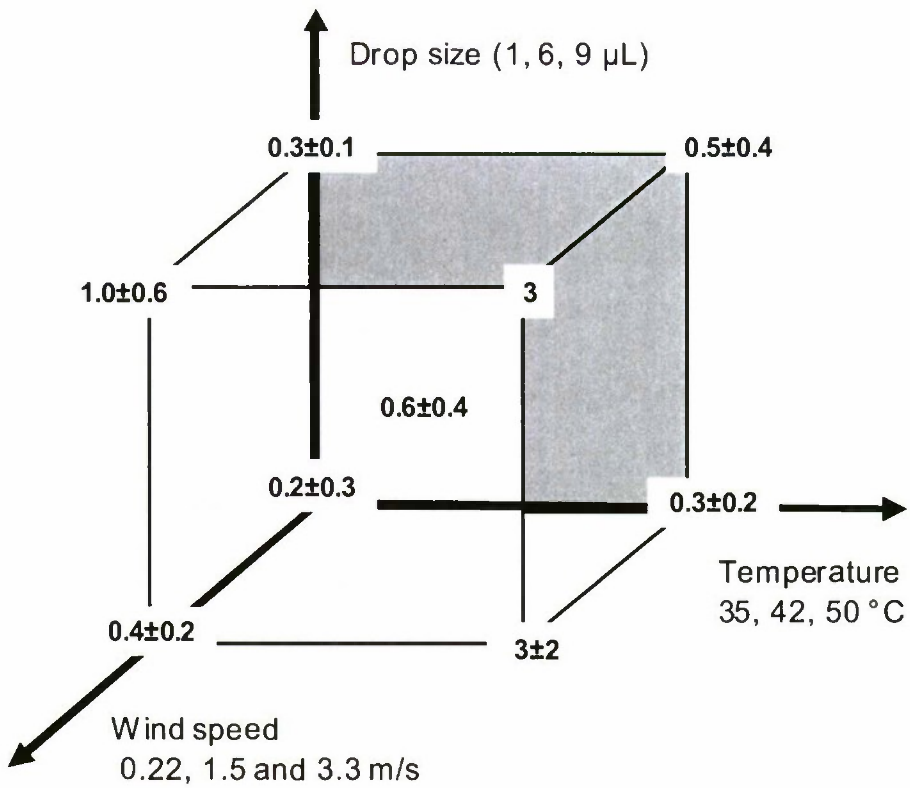


Figure 6. Cube plot of the evaporation rate (µg/min) of VX from sand.

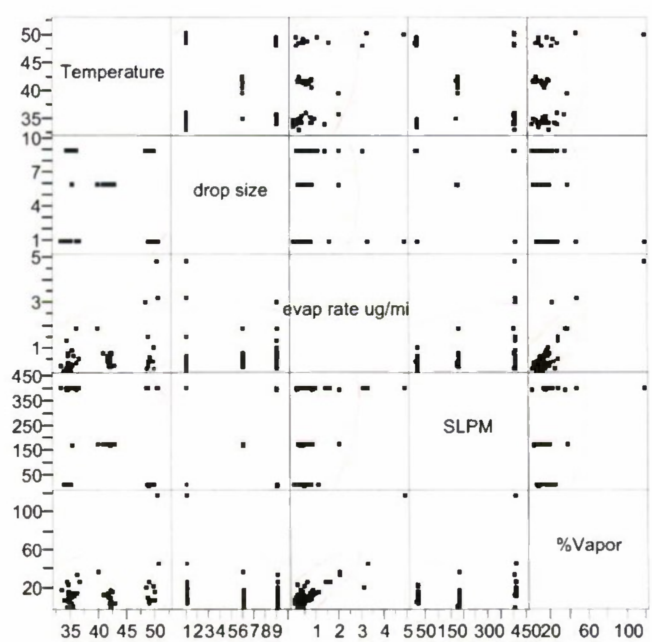


Figure 7. Scatterplot of temperature, drop mass, air flow (SLPM), %vapor recovery and evaporation rate (µg/min) for VX on sand.

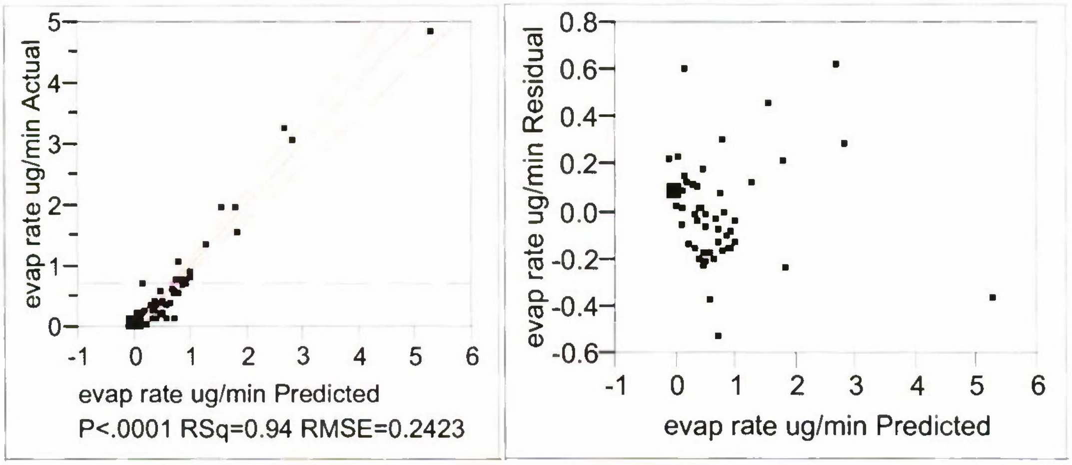
the %VX vapor recovered and evaporation rate data were calculated from the vapor concentrations, a correlation between the two is not surprising.

Numerical analysis of the data - namely, using a least squares fit for the evaporation rates (μg/min) as a function of substrate temperature (°C), droplet mass (mg), air flow (SLPM), %VX vapor recovered, and the interacting factors temperature*mass, temperature*air flow and mass*air flow was performed (Figure 8, Table 2). The r^2 was 0.94; r_{adj}^2 was 0.93, and the statistically significant factors were temperature, droplet mass, air flow, %VX vapor recovered, temperature*air flow, temperature*drop mass and drop mass*air flow; 51 data points were used. No effects due to tunnel identity were observed. The equation generated by the least squares regression equation (eq 1) was also used to predict the evaporation rate for each sample (Table 3).

$$\begin{aligned}\text{Evaporation rate} = {} & -2.8 + 5.3 \times 10^{-2}\text{*temperature} + 7 \times 10^{-2}\text{*drop mass} \\ & + 2.1 \times 10^{-3}\text{*air flow} + 3.6 \times 10^{-2}\text{*\%VX vapor recovered} \\ & + 2.4 \times 10^{-4}\text{*(drop mass-5.5)*(air flow-188)} \\ & + 2.5 \times 10^{-4}\text{*(temperature-40.6)*(air flow-188)} \\ & + 5 \times 10^{-3}\text{*(temperature-40.6)*(drop mass-5.5)} \qquad (1)\end{aligned}$$

3.1.2 Relative Effects of Agent Degradation and Evaporation.

The simultaneous effect of degradation and evaporation was calculated. Degradation rates for VX on air-dried sand have been measured;[2] the rate relevant constants were $k = 0.0912$ hr^{-1} at 50 °C and the interpolated $k = 0.057$ hr^{-1} at 35 °C. Thus, the percentages of VX that had evaporated, degraded and remained were plotted as a function of time for 35 and 50 °C (Figure 9). Although the time at which the samples were extracted was not reliably recorded, many of the samples were extracted after the evaporation experiments. The average %VX remaining in the sand was 10%, greater than had been predicted (Figure 9).

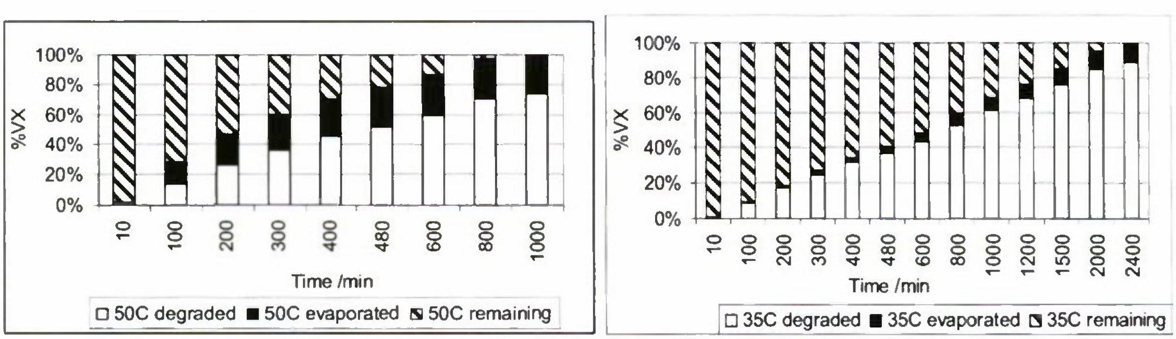


a b

Figure 8. Actual versus predicted plots for the evaporation rates (µg/min) for VX on sand. (a) Least squares regression fit ($r^2 = 0.94$; $r^2_{adj} = 0.93$) and (b) residuals.

Table 2. Parameter Estimates for the Major Effects Contributing to the Evaporation Rate (µg/min) for the Evaporation of VX from Sand[2]

Term	Estimate	Std Error	Prob>|t|
Intercept	-2.8	0.3	<.0001
Temperature (°C)	5.3×10^{-2}	7×10^{-3}	<.0001
droplet mass (mg)	7×10^{-2}	1×10^{-2}	<.0001
air flow rate (SLPM)	2.1×10^{-3}	3×10^{-4}	<.0001
(Temperature-40.6)*(drop size-5.5)	5×10^{-3}	2×10^{-3}	0.0110
(drop size-5.5)*(SLPM-188)	2.4×10^{-4}	6×10^{-5}	0.0002
(Temperature-40.6)*(SLPM-188)	2.5×10^{-4}	4×10^{-5}	<.0001
%VX Vapor Recovered	3.6×10^{-2}	3×10^{-3}	<.0001



(a) (b)

Figure 9. Relative contributions of degradation and evaporation for the loss of VX from sand. (a) 50 °C and (b) 35 °C

Table 3. Conditions and Experimental Evaporation Rates for VX on Sand

Code	Tunnel	Type*	Temperature (°C)	Nominal Drop Size (mg)	Air Flow Rate (SLPM)	%VX extracted	%Vapor	Total %VX	VX purity (%)	Evaporation rate (µg min^{-1})	Predicted evaporation rate (µg min^{-1})	Average Evaporation rate (µg min^{-1})	Std dev Evaporation rate (µg min^{-1})
3c187	3c	- - -	33.8	1.01	18	8.2	8.7	16.9	88.7	0.057	0.10		
3a150	3a	- - -	34.6	1.01	18.1	7.8	6.5	14.3	88.7	0.05	0.01		
3c176	3c	- - -	34.7	1.01	18.1	na	25.0	25.0	91.4	0.17	0.69		
3c177	3c	- - -	35.0	1.01	18.1	na	12.0	12.0	86.0	0.084	0.21		
3l045	3l	- - -	34.6	1.01	18.6	7.6	9.8	17.4	88.7	0.75	0.13		
3k047	3k	- - -	35.1	1.01	18.8	7.1	5.4	12.5	88.7	0.05	-0.03	0.2	0.3
3a141	3a	- + +	34.4	9.09	400.7	na	1.1	1.1	85.5	0.17	0.31		
3c178	3c	- + +	34.7	9.09	404.3	na	13.8	13.8	85.0	0.82	0.81		
3c191	3c	- + +	36.1	9.09	404.9	21.6	35.3	56.9	93.2	2.0	1.77		
3a154	3a	- + +	34.3	9.09	405.4	26.9	27.3	54.2	93.2	1.4	1.26		
3l048	3l	- + +	35.4	9.09	405.4	18.3	15.5	33.8	89.0	0.94	0.97		
3k050	3k	- + +	35.7	9.09	405.9	19.2	12.3	31.5	89.0	0.75	0.89	1.0	0.6
3l059	3l	- - +	36.5	1.01	406.2	6.3	28.4	34.7	92.0	0.61	0.76		
3l057	3l	- - +	35.2	1.01	406.2	8.6	13.8	22.4	92.0	0.14	0.12		
3k060	3k	- - +	36.0	1.01	406.4	9.2	15.9	25.1	92.0	0.39	0.26		
3k058	3k	- - +	33.4	1.01	406.4	6.0	18.5	24.5	92.0	0.29	0.13	0.4	0.2
3c199	3c	- + -	34.6	9.09	18.0	22.5	18.0	40.5	92.0	0.43	0.41		
3c198	3c	- + -	34.7	9.09	18.0	36.2	11.2	47.4	92.0	0.3	0.16		
3a162	3a	- + -	35.2	9.09	18.1	25.5	15.2	40.7	92.0	0.32	0.32		
3a161	3a	- + -	34.6	9.09	18.1	23.2	9.2	32.4	92.0	0.19	0.09	0.3	0.1
3l058	3l	+ - -	49.8	1.01	19.5	9.8	8.0	17.8	92.0	0.14	-0.10		
3l061	3l	+ - -	49.6	1.01	19.6	11.9	23.6	35.5	92.0	0.48	0.47	0.3	0.2
3l047	3l	+ - +	50.7	1.01	405.4	4.9	118.6	123.6	90.8	3.3	2.67		
3l051	3l	+ - +	50.3	1.01	405.5	5.0	28.3	39.0	93.2	4.9	5.25		
3k049	3k	+ - +	48.8	1.01	405.7	10.7	6.2	13.3	90.8	1.6	1.83	3.0	2.0
3k062	3k	+ + -	48.5	9.09	19.5	11.5	46.8	51.7	92.0	0.18	0.54		
3c189	3c	+ + -	48.8	9.09	16.5	7.1	11.1	22.6	89.0	0.47	0.35		

Table 3. (Continued)

Code	Tunnel	Type*	Temp-erature (°C)	Nominal Drop Size (mg)	SLPM	%VX extracted	%Vapor	Total %VX	VX purity (%)	Evaporation rate (μg min⁻¹)	Predicted evaporation rate (μg min⁻¹)	Average Evaporation rate (μg min⁻¹)	Std dev Evaporation rate (μg min⁻¹)
3l050	3l	+ + -	49.9	9.09	18.7	8.8	16.8	25.6	93.2	1.1	0.78		
3k052	3k	+ + -	49.2	9.09	18.9	2.9	7.9	10.8	93.2	0.63	0.44		
3a152	3a	+ + -	48.9	9.09	19.0	10.5	5.3	15.8	89.0	0.31	0.34	0.5	0.4
3k061	3k	+ + +	48.4	9.09	406.5	20.8	21.1	41.9	92.0	3.1	2.80	3.1	n/a
3a139	3a	0 0 0	35.4	6.06	179.9	na	2.9	2.9	94.0	0.26	0.02		
3a140	3a	0 0 0	42.2	6.06	179.9	na	2.7	2.7	85.5	0.41	0.38		
3c188	3c	0 0 0	41.9	6.06	181.0	4.9	11.8	16.7	91.2	0.63	0.70		
3a151	3a	0 0 0	40.9	6.06	181.2	5.1	14.5	19.6	91.7	0.83	0.74		
3c179	3c	0 0 0	41.5	6.06	181.4	0.6	12.9	13.5	90.7	0.6	0.71		
3c185	3c	0 0 0	42.9	6.06	181.5	na	4.5	4.5	89.4	0.29	0.49		
3c186	3c	0 0 0	42.1	6.06	181.5	0.7	4.9	5.6	90.9	0.24	0.46		
3c190	3c	0 0 0	42.3	6.06	181.5	na	16.9	16.9	89.0	0.83	0.90		
3l043	3l	0 0 0	42.2	6.06	181.5	na	7.4	7.4	89.4	0.39	0.55		
3a142	3a	0 0 0	42.0	6.06	181.6	0.7	4.9	5.6	90.7	0.24	0.45		
3a153	3a	0 0 0	41.7	6.06	181.6	na	10.5	10.5	89.0	0.45	0.64		
3l044	3l	0 0 0	42.2	6.06	181.6	0.6	6.0	6.6	90.9	0.45	0.50		
3l046	3l	0 0 0	42.1	6.06	181.6	4.3	19.4	23.7	90.7	0.87	0.99		
3l049	3l	0 0 0	42.1	6.06	181.6	na	16.9	16.9	89.0	0.75	0.89		
3k045	3k	0 0 0	41.8	6.06	181.7	na	4.9	4.9	89.4	0.28	0.44		
3a148	3a	0 0 0	42.0	6.06	181.8	na	2.9	2.9	89.4	0.19	0.38		
3a149	3a	0 0 0	42.0	6.06	181.8	0.7	4.7	5.4	90.9	0.25	0.45		
3k046	3k	0 0 0	42.2	6.06	181.8	0.6	10.5	11.1	90.9	0.65	0.67		
3k048	3k	0 0 0	41.6	6.06	181.8	4.0	15.9	19.9	90.7	0.74	0.83		
3k051	3k	0 0 0	39.9	6.06	181.8	na	37.7	37.7	89.0	2.0	1.53	0.6	0.4

*The 'Type' represents the environmental parameters in the order temperature, drop size, air flow rate.

3.2 Concrete.

3.2.1 Evaporation Rates.

The vapor concentration of the VX evaporating from the concrete was measured as a function of temperature, air flow rate and drop size. The evaporation profiles of the VX vapor concentration (mg/m^3) were plotted as a function of time (Figure 10, Appendix B). The VX vapor was collected until the concentration of agent reached an approximate plateau, often ~1 x 10^{-4} mg/m^3, which was about 4000 to 7000 min for most samples. At 50 °C, the whole agent had evaporated by 1000 min; whereas, at 35 °C, the evaporation was sometimes not complete until 7000 min. Examples of replicate collections of evaporation data at two different conditions demonstrate the degree of variability observed (Figure 10). VX vapor concentrations were above the Immediately Dangerous to Life and Health (IDLH) value of 0.003 mg/m^3 for about 5 h for the 50 °C samples and about 15 h for the 35 °C samples.

Distribution plots of %VX vapor recovered and %VX extracted from the concrete after evaporation showed averages of 17 and 2%, respectively, although the data exhibited high variability (Figure 11, Table 4). Thus, on average, 81% of the VX was neither evaporated nor extracted.

The evaporation rates were calculated in the same manner as those for the sand samples. Examples of replicate plots of cumulative %VX versus time at two different conditions demonstrate the degree of variability observed in the experiments (Figure 12). However, as shown in the cube plot (Figure 13), fewer combinations of environmental conditions were measured for concrete than for sand. The evaporation rates ranged from 0.02 to 3 µg/min.

Scatterplots of the variables substrate temperature (°C), droplet mass (mg), and air flow (SLPM), and the results from %VX vapor recovered and evaporation rate (µg/min) showed that the %VX vapor recovered and the evaporation rate (µg/min) were loosely correlated with each other (r = 0.76,[‡] Figure 14). None of the other parameters were correlated. Because the total %VX vapor recovered and the evaporation rate were both derived from the measurement of VX vapor as a function of time, a correlation between them was not entirely unexpected. Perusal of the data showed that the correlation between %VX vapor recovered and the evaporation rate held for the '000' condition, which had small variations in temperature and drop size (Figure 15).

There was sufficient data for a numerical analysis to probe the effect of temperature, drop mass, air flow rate, and %VX vapor recovered, but too little data to generate any cross-effects. The concrete CZ04 was used for 27 experiments; concretes that were made with different w/c ratios were used for an additional 21 experiments (Table 5).

The effect of the environmental parameters on the $\log_{10}$(evaporation rate) was analyzed using a least squares regression method (Figure 16, Table 5). The data were analyzed

‡ r is the Pearson Product-Moment correlation; a perfect fit is r = 1.0. JMP Statistics and Graphics Guide, Version, SAS Institute, Cary, NC, 2002, p 376.

using all of the concrete samples together, with no distinction (n = 48) and with the CZ04 concrete samples separately (n = 27). For the $\log_{10}$(evaporation rate) with n = 27 and n = 48, all factors were significant, with $r^2 = 0.85$ in both cases; whereas, for the evaporation rate, with n = 27 and n = 48, only drop size and %vapor recovered were significant, and the r^2 were 0.62 and 0.71, respectively (Table 6).

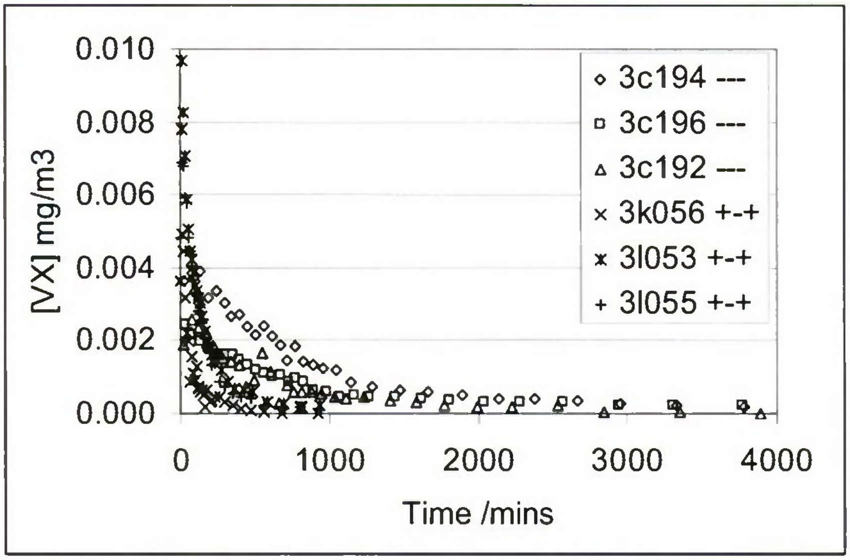


Figure 10. Plot of the concentration of VX vapor (mg/m^3) with time for 1 μL droplets of VX evaporating from CZ04 concrete at 35 °C, 18 SLPM (△,□,◇) and 50 °C, 405 SLPM (×,+,✱).

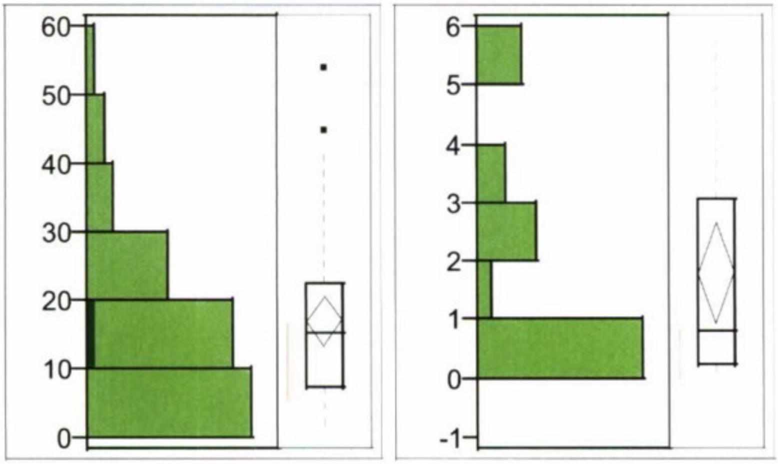


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Figure 11. Distributions for (a) %VX vapor collected and (b) %VX extracted from concrete samples after evaporation.

Table 4. Mean %VX Vapor Recovery and %VX Extracted from Concrete after Evaporation

	%vapor recovery	%Extracted
Mean	17.0	2.0
Std Dev	12.0	2.0
Std Err Mean	1.7	0.4
Upper 95% Mean	20.0	2.6
Lower 95% Mean	13.0	0.9
N	49.0	21.0

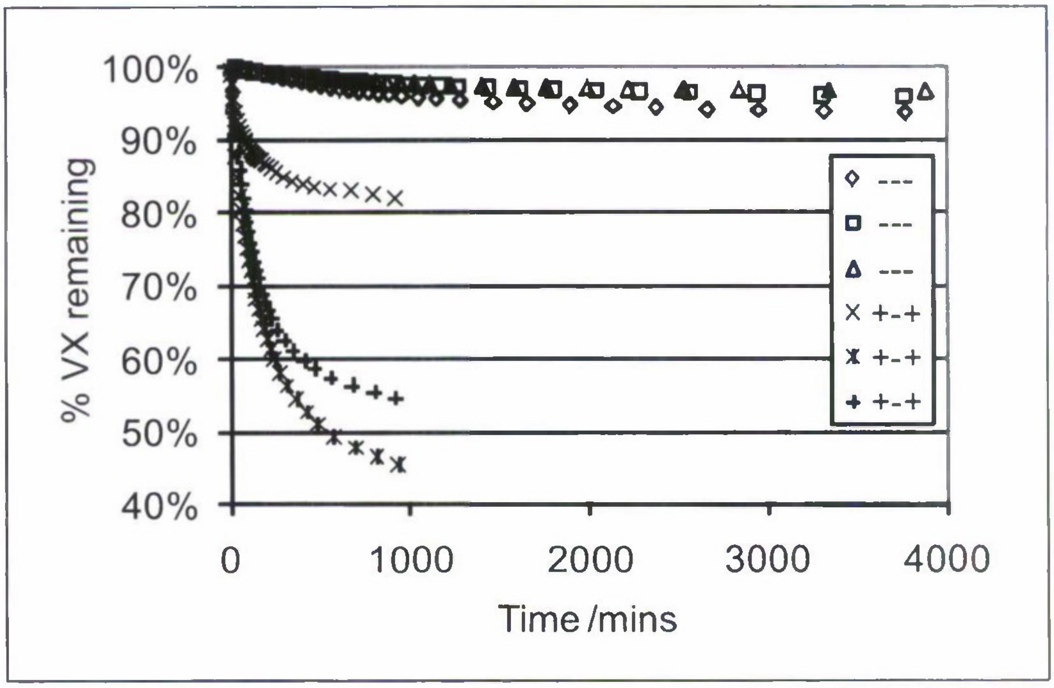

Figure 12. Cumulative VX vapor recovered for 1 µL droplets of VX evaporating from CZ04 concrete at 35 °C, 18 SLPM (△,□,◇) and 50 °C, 405 SLPM (×,+,∗).

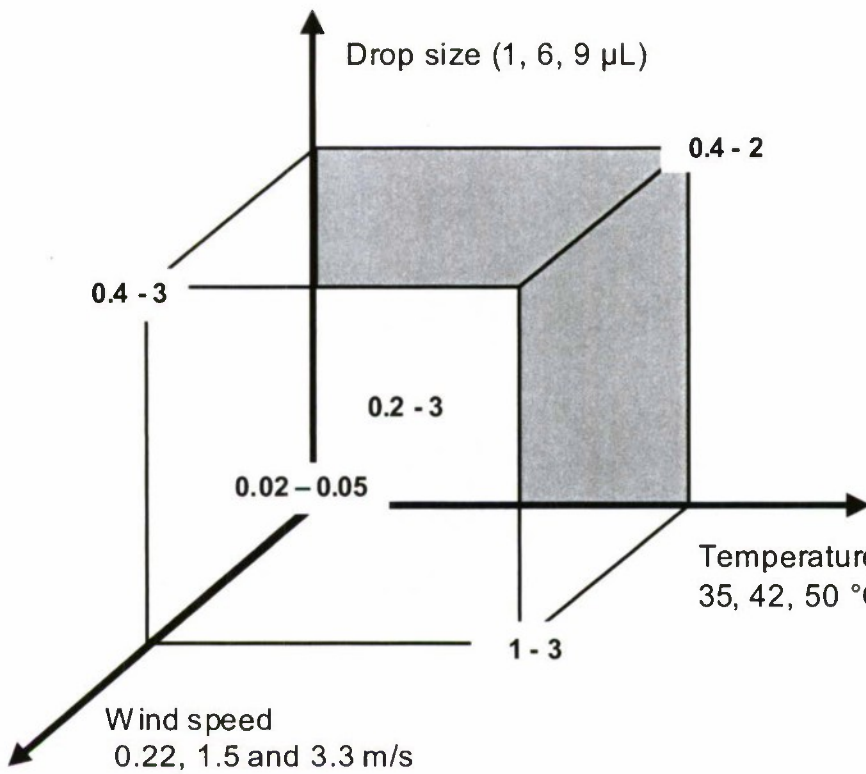

Figure 13. Cube plot of the evaporation rate (µg/min) of VX from CZ04 concrete, 27 samples.

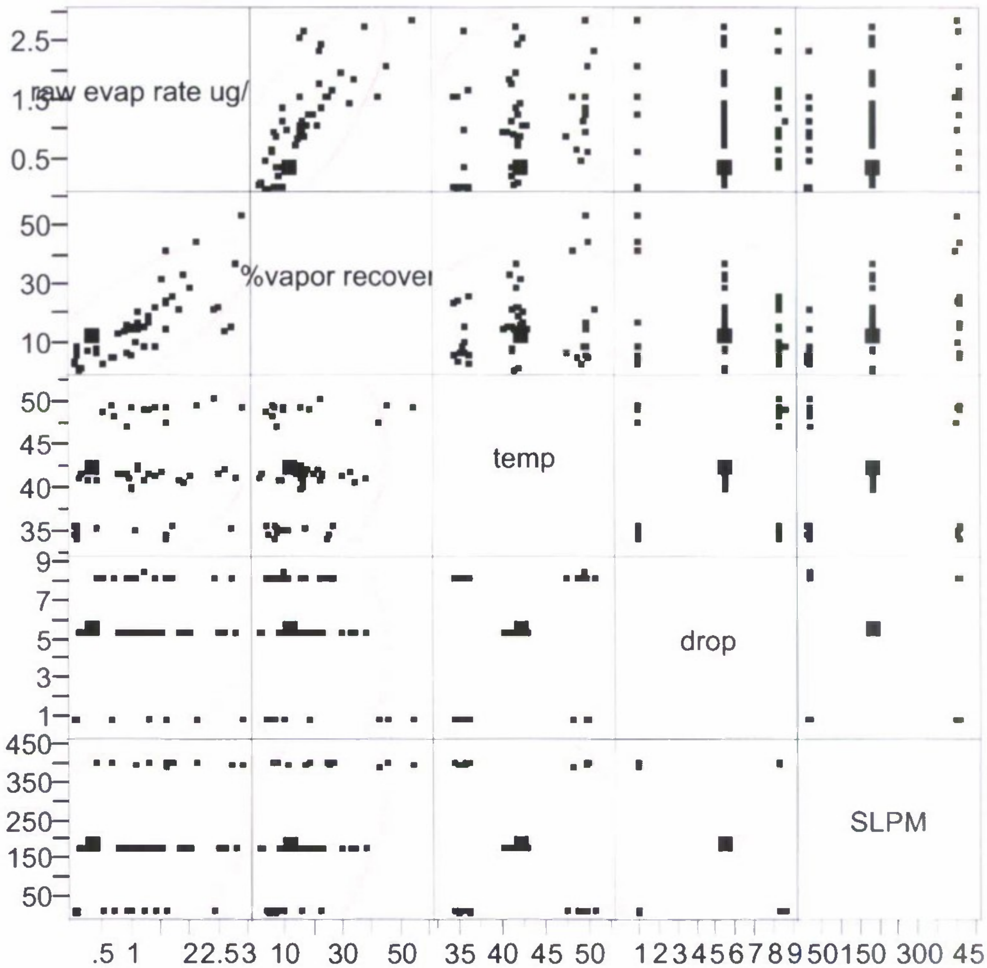

Figure 14. Scatterplot for the evaporation rate (µg/min) and %VX vapor recovered over the range of temperature (°C), drop size (µL) and air flow rate (SLPM) (48 samples).

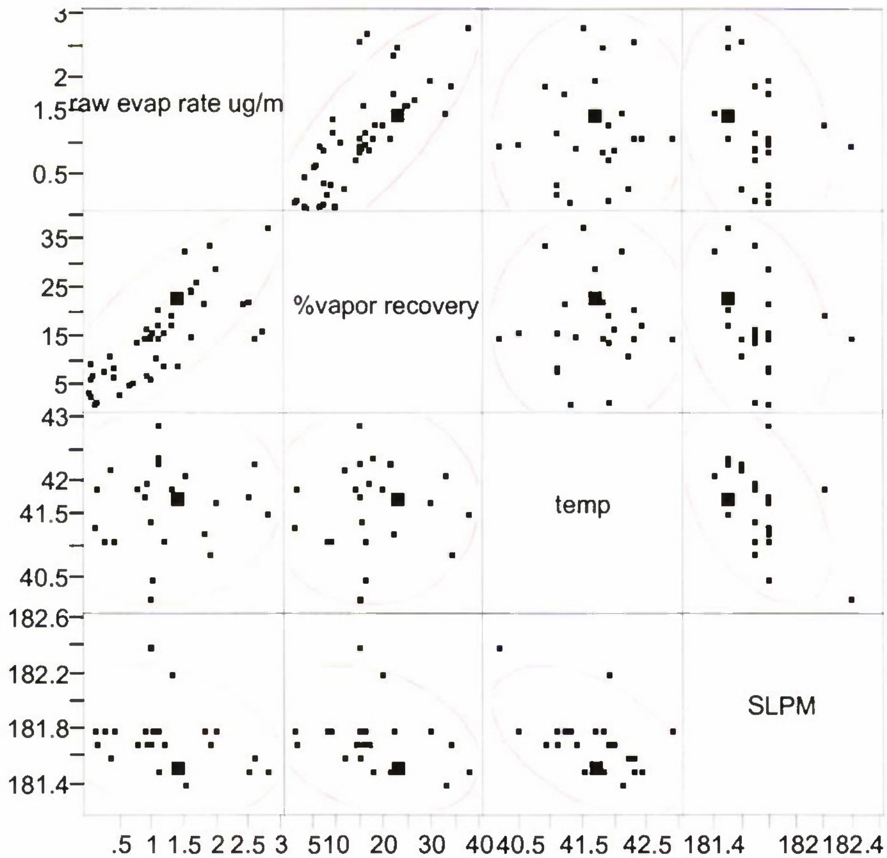

Figure 15. Scatterplot for the evaporation rate (μg/min) and %VX vapor recovered at the nominal '000' condition of 35 °C, 1 μL, and 181 SLPM air flow rate (23 samples).

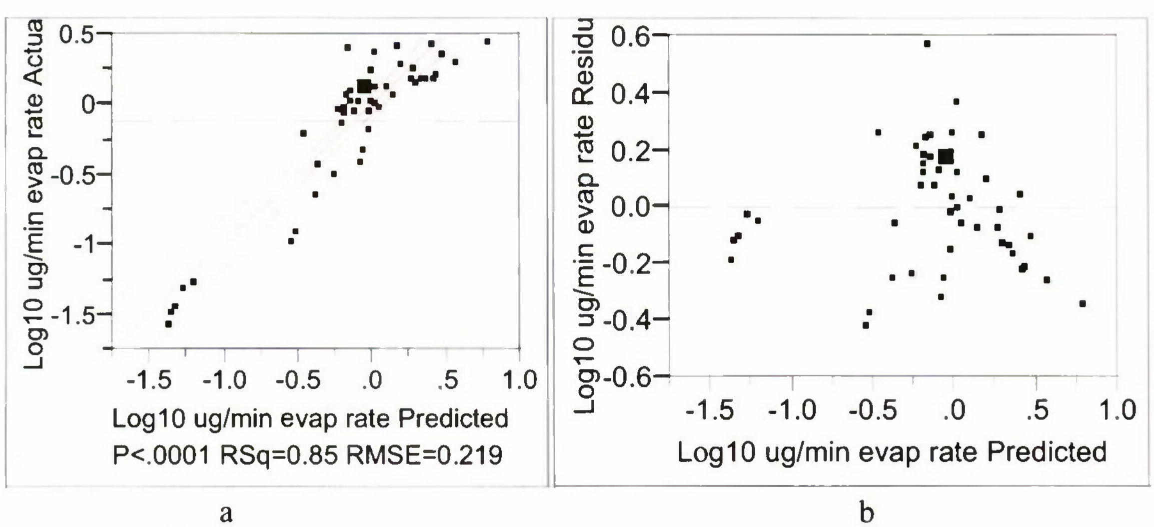

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Figure 16. Actual versus predicted plots for the $\log_{10}$(evaporation rate) (μg/min) for VX on concrete, n = 48. (a) $\log_{10}$(evaporation rate) and (b) residuals.

Table 5. Conditions and Experimental Evaporation Rates for VX on Various Concrete Samples

Code	Type*	Temp (°C)	Drop size (µL)	Air flow Rate (SLPM)	Evap Rate (µg/min)	Concrete	Average Evap Rate (µg/min)	StdDev Evap Rate (µg/min)	%vapor recovered	%VX vapor extracted	End time (min)	$\log_{10}$Evap Rate (µg/min)	PredEvap Rate (µg/min)	Pred $\log_{10}$Evap Rate (µg/min)
3c-194	- - -	36.0	0.92	16.4	0.051	CZ04			6.5	0	3800	-1.29	0.03	-1.27
3c-196	- - -	34.9	0.92	16.5	0.028	CZ04			3.9	5.0	4000	-1.55	-0.13	-1.38
3c-192	- - -	36.0	0.92	17.2	0.034	CZ04	0.031	0.004	3.2	0.3	4000	-1.47	-0.15	-1.36
3c-200	- - -	34.4	0.92	18.0	0.038	0.45 BR			6.4	nm	3800	-1.42	0.00	-1.33
3a-163	- - -	35.4	0.92	18.1	0.056	0.45 BR	0.05	0.01	9.7	nm	3800	-1.25	0.19	-1.21
3c-193	- + +	35.5	8.27	404.9	1.05	CZ04			10.9	5.2	5000	0.02	1.06	0.01
3c-197	- + +	35.7	8.27	405.0	2.7	CZ04			16.5	0.8	5900	0.43	1.36	0.17
3a-156	- + +	35.6	8.27	405.1	0.41	CZ04			7.2	2.7	5000	-0.39	0.86	-0.08
3a-160	- + +	34.3	8.27	405.3	1.6	CZ04	1.4	1.0	24.7	5.7	6000	0.20	1.78	0.33
3a-165	- + +	36.0	8.27	405.5	1.7	0.45 BR			26.5	nm	5000	0.23	1.90	0.43
3c-202	- + +	34.9	8.27	404.9	1.6	0.45 BR	1.65	0.07	25.1	nm	5000	0.20	1.81	0.36
3c-204	0 0 0	41.7	5.51	181.5	1.4	0.35 BR			22.8	nm	3000	0.15	1.49	0.02
3a-167	0 0 0	40.9	5.51	181.7	1.9	0.35 BR			34.1	nm	3000	0.28	2.09	0.28
3a-166	0 0 0	41.7	5.51	181.8	2.0	0.35 BR			29.6	nm	3000	0.30	1.86	0.19
3c-203	0 0 0	41.5	5.51	181.5	2.8	0.35 BR	2.0	0.6	37.8	nm	3000	0.45	2.30	0.40
3l-062	0 0 0	41.1	5.51	181.7	1.2	0.45 BR			16.1	nm	4000	0.08	1.12	-0.18
3k-063	0 0 0	41.2	5.51	181.8	1.8	0.45 BR	1.5	0.4	22.3	nm	3800	0.26	1.46	-0.01
3k-068	0 0 0	41.3	5.51	181.8	0.11	0.45 SM			1.4	nm	3000	-0.96	0.34	-0.55
3l-067	0 0 0	41.9	5.51	181.7	0.13	0.45 SM			1.7	nm	3000	-0.89	0.36	-0.52
3k-067	0 0 0	40.2	5.51	182.4	0.98	0.45 SM			15.1	nm	3000	-0.01	1.05	-0.23
3l-066	0 0 0	41.9	5.51	182.2	1.3	0.45 SM	0.6	0.6	19.8	nm	3000	0.11	1.33	-0.05
3l-070	0 0 0	41.9	5.51	181.7	0.77	0.50 BR			14.1	nm	3000	-0.11	1.03	-0.20
3k-069	0 0 0	41.8	5.51	181.8	0.89	0.50 BR			14.9	nm	3000	-0.05	1.07	-0.18
3l-068	0 0 0	42.0	5.51	181.7	0.92	0.50 BR			17.1	nm	3000	-0.04	1.19	-0.12
3k-071	0 0 0	40.5	5.51	181.8	1.0	0.50 BR	0.90	0.09	16.2	nm	3000	0.00	1.12	-0.20
3a-172	0 0 0	41.1	5.51	181.8	0.24	CZ04			8.2	nm	3800	-0.62	0.70	-0.38
3a-171	0 0 0	42.2	5.51	181.6	0.33	CZ04			11.6	nm	3800	-0.48	0.90	-0.26
3a-155	0 0 0	41.1	5.51	181.8	0.39	CZ04			8.9	0.2	3800	-0.41	0.74	-0.36
3a-158	0 0 0	41.4	5.51	181.7	0.96	CZ04			15.5	2.4	4300	-0.02	1.09	-0.18
3c-195	0 0 0	42.3	5.51	181.5	1.1	CZ04			21.2	2.0	4300	0.04	1.42	-0.01

Table 5. (Continued)

Code	Type*	Temp (°C)	Drop size (μL)	Air flow Rate (SLPM)	Evap Rate (μg/min)	Concrete	Average Evap Rate (μg/min)	StdDev Evap Rate (μg/min)	%vapor recovered	%VX vapor extracted	End time (min)	$\log_{10}$Evap Rate (μg/min)	Pred Evap Rate (μg/min)	Pred $\log_{10}$Evap Rate (μg/min)
3a-157	0 0 0	42.4	5.51	181.5	1.1	CZ04			17.6	3.6	3600	0.04	1.22	-0.09
3a-159	0 0 0	42.9	5.51	181.8	1.1	CZ04			15.1	1.4	3800	0.04	1.10	-0.14
3c-207	0 0 0	42.1	5.51	181.4	1.5	CZ04			32.9	nm	4400	0.18	2.04	0.29
3c-208	0 0 0	41.8	5.51	181.5	2.5	CZ04			22.8	nm	4000	0.40	1.49	0.02
3a-170	0 0 0	42.3	5.51	181.6	2.6	CZ04	1.2	0.8	15.0	nm	4400	0.41	1.08	-0.16
31-063	+ - +	49.9	0.92	405.7	0.65	0.45 BR	0.65		5.5	nm	900	-0.19	0.25	-0.46
3k-056	+ - +	49.5	0.92	406.4	1.3	CZ04			18.0	0.7	900	0.11	0.91	-0.15
3k-054	+ - +	48.0	0.92	398.9	1.6	CZ04			42.1	0	900	0.20	2.18	0.41
31-055	+ - +	49.9	0.92	406.1	2.1	CZ04			45.4	0.6	900	0.32	2.39	0.57
31-053	+ - +	49.7	0.92	403.6	2.9	CZ04	2.0	0.7	54.5	0	900	0.46	2.88	0.79
3k-066	+ + -	48.7	8.27	18.8	0.69	0.45 BR			5.7	nm	5000	-0.16	0.96	-0.02
31-065	+ + -	49.6	8.27	18.8	1.6	0.45 BR	1.1	0.6	15.6	nm	5000	0.20	1.51	0.26
31-052	+ + -	50.7	8.27	19.3	2.4	CZ04			22.1	nm	3000	0.38	1.87	0.47
3k-055	+ + -	47.3	8.27	19.4	0.92	CZ04			7.3	3.4	5000	-0.04	1.02	-0.03
3k-057	+ + -	49.1	8.27	19.4	0.49	CZ04			3.4	0	3000	-0.31	0.84	-0.07
31-054	+ + -	49.6	8.27	19.4	1.4	CZ04			9.4	0.7	3000	0.15	1.17	0.10
31-056	+ + -	49.7	8.27	19.4	0.99	CZ04			6.7	0.5	3000	0.00	1.03	0.04
3k-053	+ + -	49.4	8.65	19.4	1.2	CZ04	1.2	0.6	9.5	2.4	5000	0.08	1.21	0.14

*Type represents the environmental parameters in the order temperature, drop size and air flow rate.

Table 6. Summary of Estimates of the Factors Affecting Evaporation Rates (μg/min) for VX on Concrete

Estimates	$\log_{10}$(evaporation rate)	$\log_{10}$(evaporation rate)	evaporation rate	evaporation rate
Number of samples	48 all	27 CZ04 only	48 all	27 CZ04 only
r^2	0.85	0.85	0.71	0.62
r^2_{adj}	0.83	0.82	0.69	0.54
Intercept	-2.8	-2.8	not a factor	not a factor
temperature (°C)	0.034	0.034	not a factor	not a factor
droplet size (μL)	0.11	0.12	0.10	0.12
air flow rate (SLPM)	0.0009	0.001	not a factor	not a factor
%VX vapor recovery	0.026	0.022	0.054	0.053

3.2.2 Effect of Variations in the Formulation of the Concrete.

The w/c ratio of the concrete was varied on the assumption that the concomitant changes in surface area, pore volume, and porosity would be reflected in the evaporation rates.[8] Because the CZ04 was made on an industrial scale and cured in a different location and in different molds from the other samples, the CZ04 is excluded from direct comparisons when looking at the trends in physical properties. For the lab series concrete samples, 0.35 BR, 0.45 BR, 0.45 SM and 0.50 BR, trends in the pore diameter, skeletal density, and surface area were seen; no trends were seen in pore volume or %porosity (Table 7, Appendixes E, F, G). The samples labeled 0.45 BR and 0.45 SM were the top (brushed) and bottom (smooth) of the same piece of concrete, respectively.

The statistical test chosen was a comparison of the means of the laboratory-made concrete samples to the CZ04. There was sufficient variability in the CZ04 evaporation rate data that most of the rates from the laboratory-made concrete samples fell within the envelope of the CZ04 evaporation rates (Figure 17).

A Student t-test of the evaporation rates showed that only the 0.35 w/c sample was significantly different from the other (Table 8). An analysis of the %vapor recovered yielded similar results (Figure 18, Table 9).

The least squares regression of the entire set of data (n = 48) for evaporation rate and $\log_{10}$(evaporation rate) were used to predict the rates; plots of predicted versus observed rates are shown in Figures 19 and 20, respectively, with the types of concrete represented by different symbols. The overlap in the evaporation rates from the different concrete samples is evident in Figures 19 and 20.

Table 7. Concrete Formulations and Properties from Mercury Intrusion Porosimetry (MIP)

	0.35 BR	0.45 BR & 0.45 SM	0.50 BR	0.45 CZ04
Average pore diameter (microns)	0.042	0.038	0.024	0.022
Skeletal Density (g/mL)	2.40	2.45	2.54	2.54
Surface Area (m^2/g) minislab	6.8	7.6	10.9	10.4
Pore Volume (cm^3/g) minislab	0.072	0.073	0.065	0.057
%Porosity	14.8	15.1	14.1	12.7

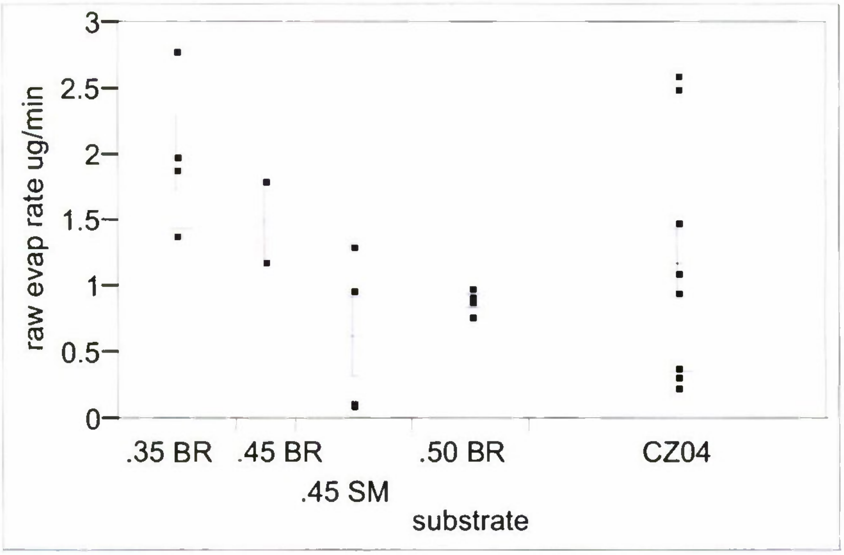


Figure 17. Evaporation rates of 5.5 mg VX from different formulations of concrete at 42 °C, 181 SLPM.

Table 8. Means, Standard Deviations and Student t-tests for Evaporation Rates (μg/min) on Concrete Samples of Different Formulations

Concrete Type*	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%	*	*
0.35 BR	4	2.03	0.58	0.29	1.10	2.95	A	
0.45 BR	2	1.50	0.42	0.30	-2.31	5.31	A	B
0.45 SM	4	0.63	0.60	0.30	-0.33	1.59		B
0.50 BR	4	0.90	0.10	0.05	0.74	1.05		B
CZ04	10	1.18	0.83	0.26	0.59	1.77		B

*Concrete Types not connected by same letter are significantly different.

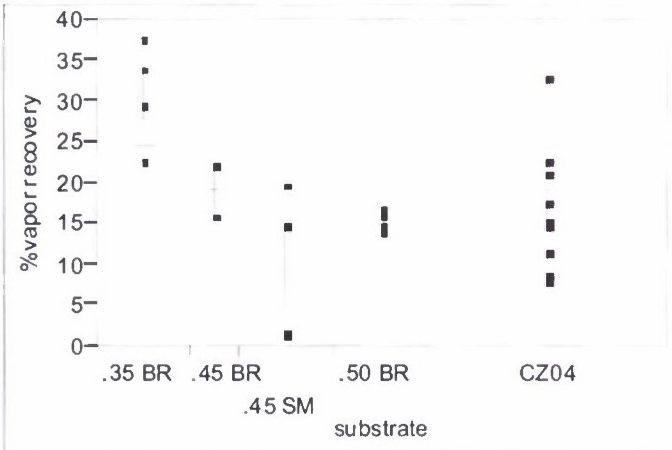


Figure 18. %Vapor recovery for 5.5 mg VX evaporating from various concrete samples at 42 °C, 181 SLPM.

Table 9. Means, Standard Deviations and Student t-tests for %Vapor Recovery on Concrete Samples of Different Formulations

Concrete Type*	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%	*	*
0.35 BR	4	31.1	6.5	3.2	20.8	41.4	A	
0.45 BR	2	19.2	4.4	3.1	-20.2	58.6	A	B
0.45 SM	4	9.5	9.4	4.7	-5.4	24.4		B
0.50 BR	4	15.6	1.3	0.7	13.4	17.7		B
CZ04	10	16.9	7.4	2.3	11.6	22.1		B

* Concrete Types not connected by same letter are significantly different.

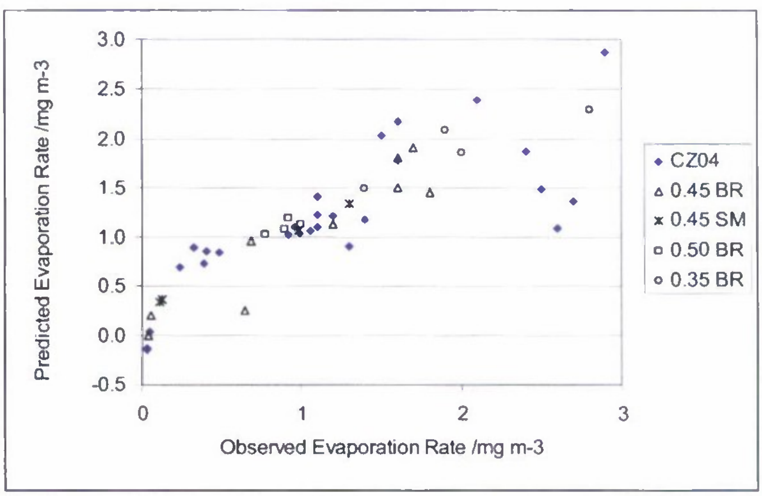


Figure 19. Predicted versus actual plots for the evaporation rate (μg/min) of VX on concrete, showing the effect of the various concrete samples.

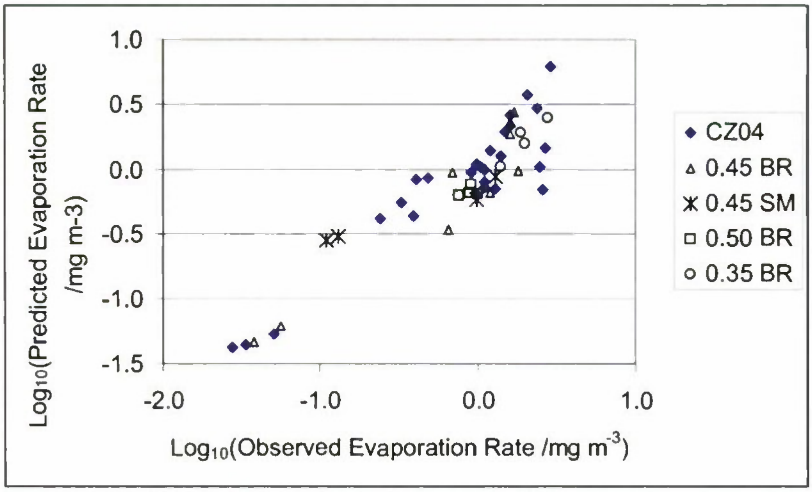


Figure 20. Predicted versus actual plots for the $\log_{10}$(evaporation rate) (µg/min) of VX on concrete, showing the effect of the various concrete samples.

4. DISCUSSION

4.1 Comparison of VX Evaporation Rates on Glass, Sand and Concrete Substrates.

Comparative plots of VX vapor concentration versus time for 1 µL droplets of VX evaporation from glass, sand and concrete are shown in Figure 21. Notably, all three substrates yielded similar evaporation rates at the high temperature, high air flow condition (50 °C, 405 SLPM; '+ - +'); whereas, marked differences in the evaporation profiles from the different substrates are seen at the low temperature, low air flow (35 °C, 18 SLPM air flow '- - -') condition.

A least squares analysis of all of the evaporation rate data (n = 139) on glass, sand and concrete was performed. Three approaches were taken: all data; all data with segmentation of substrates included in the analysis; and the glass substrates only (n = 40). The evaporation rates and the $\log_{10}$(evaporation rates) were analyzed. The r^2 are given in Table 10; the $\log_{10}$ value for glass is better than for all of the data combined; segmentation of the substrates did not improve the r^2 by much. The statistical results for all of the data, segmented by substrate are shown in Table 11. The significant factors were temperature, drop mass, air flow rate and %VX recovered. For the analysis of the evaporation rates, neither substrate had a significant effect. For the analysis of the $\log_{10}$(evaporation rates), the concrete had a significant effect, but the sand did not. Plots of the predicted versus actual evaporation rates show the high degree of overlap of the evaporation rates of the VX on different substrates (Figures 22, 23). The predictive equation generated for the evaporation of VX from glass, sand and concrete is Equation 2 below:

$$\text{Log}_{10}(\text{evaporation rate}) = -2.30 + 0.0011 * \text{air flow (SLPM)} + 0.082 * \text{drop mass (mg)} + 0.014 * \%\text{vapor recovered} + 0.028 * \text{temperature (°C)} + 0.11 \text{ for concrete} \quad (2)$$

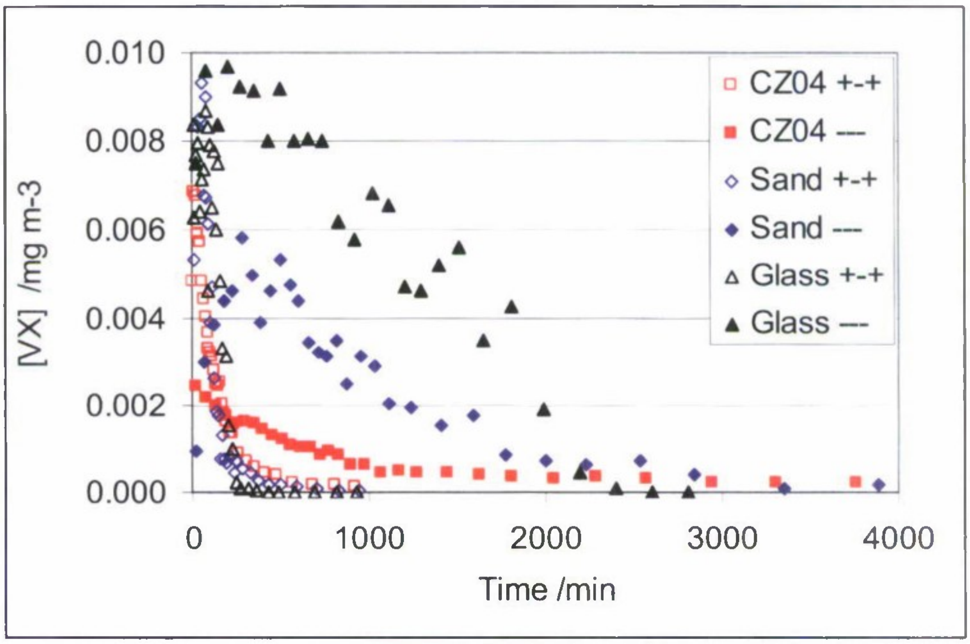


Figure 21. Plot of VX vapor concentrations (mg/m^3) versus time (min) for 1 μL droplets on glass, sand and concrete at 50 °C, 405 SLPM air flow (△,◇,□; the '+ - +' condition) and 35 °C, 18 SLPM air flow (▲, ◆, ■; the '- - -' condition).

Table 10. Regression Results from the Least Squares Regression Analysis of VX Evaporation for Glass, Sand and Concrete

Dataset	Substrates	r^2 from Evaporation Rate Analysis	r^2 from Log_{10}(Evaporation Rate) Analysis
n=139	all substrates	0.72	0.77
n=139, segmented	all substrates	0.72	0.78
n=40	glass only	0.71	0.84

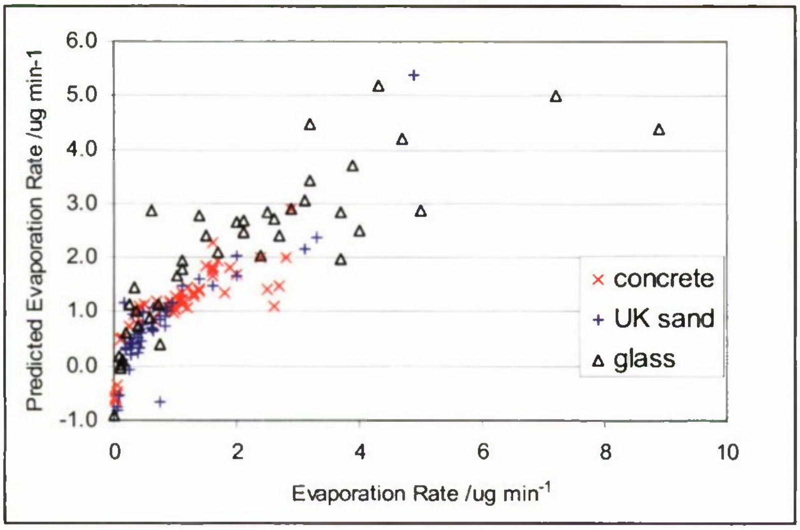


Figure 22. Plot of predicted versus actual evaporation rate (μg/min) for the evaporation of VX from glass, sand and concrete.

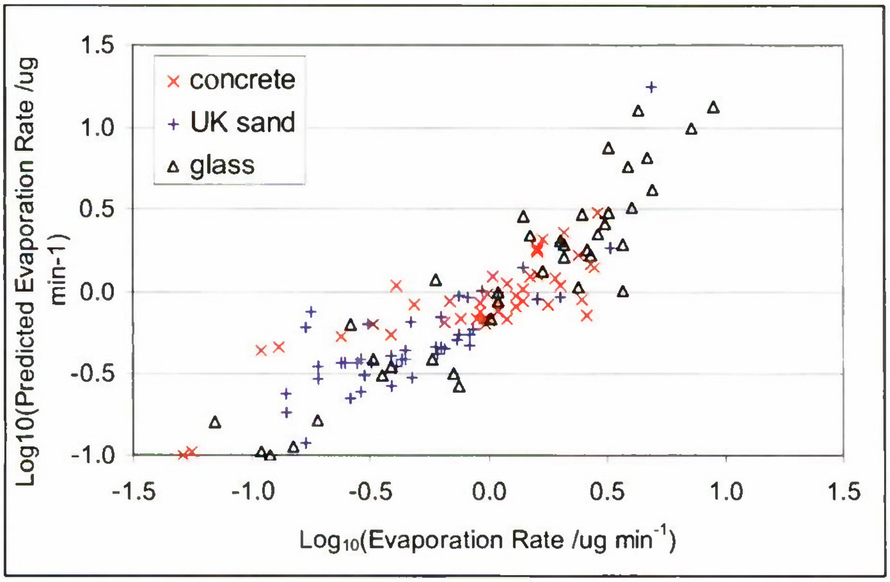


Figure 23. Plot of predicted versus actual $\log_{10}$(evaporation rate) (μg/min) for the evaporation of VX from glass, sand and concrete.

Table 11. Statistical Results for Least Squares Regression of Evaporation Rates (μg/min) of VX on Glass, Sand and Concrete

	Log_{10}(Evaporation Rate)			Evaporation Rate		
Term	Estimate	Std Error	Prob>|t|	Estimate	Std Error	Prob>|t|
Intercept	-2.30	0.16	<0.0001	-3.1	0.5	<0.0001
Temperature (°C)	0.028	0.004	<0.0001	0.06	0.01	<0.0001
Drop mass (mg)	0.082	0.008	<0.0001	0.13	0.02	<0.0001
Air flow (SLPM)	0.0011	0.0001	<0.0001	0.0015	0.0004	0.0024
%VX recovered	0.014	0.001	<0.0001	0.042	0.004	<0.0001
Substrate[Concrete]	0.11	0.03	0.0010	0.1	0.1	0.12
Substrate[UK sand]	-0.03	0.03	0.40	-0.1	0.1	0.29

4.2 Degradation of VX.

The rate of VX degradation on glass and sand has been quantified,[2] and in both cases was competitive with the evaporation rate. Preliminary studies of VX degradation on concrete were performed[10] using an airport runway sample for the Salt Lake City International Airport (SLCIA). The SLCIA concrete was of a similar formulation to the CZ04 concrete, but of unknown age. A monolayer of VX degraded on crushed SLCIA concrete with a half-life of 2.2 h; the bulk of the agent had a degradation half-life of 28 days. VX on a monolith of the same concrete had a degradation half-life of 96 days. Thus, the degradation rate of VX on concrete was not competitive with the evaporation rate, unlike glass and sand. Therefore, although the glass, sand and concrete all have similar evaporation rates, after the passage of a month one would expect residual VX in the concrete sample, but not in the sand or on the glass.

4.3 Comparison of Evaporation Rates for all Agents and Substrates.

The entirely of this project at ECBC involved 582 wind tunnel experiments of HD, H, VX, GD and thickened GD (TGD) on glass, stainless steel (GD and TGD only), sands and concrete. Different types of sand were used with the sulfur mustard (H and HD); no major differences were seen. In the studies of VX evaporation from concrete, minor trends were observed with the different types of concrete samples, but no major differences were seen.

The data for the four agents and four substrates were combined, and a regression line that expressed log_{10}(evaporation rate) in terms of temperature, drop size and air flow rate was generated. The regression was performed with equivalent treatment of all the sands, all the concretes, and the glass and stainless steel both tagged as non-porous substrates. The regression was also performed with the wind speed (m/s) in lieu of air flow rate (SLPM), because wind speed is a measurement that can be made in an operational scenario. The r^2 and r^2_{adj} were 0.89 (Figures 24a and 25a); and the residuals were randomly distributed (Figures 24b and 25b). The parameter estimates generated are summarized in Table 12; the only estimate that had a major change was the air flow versus wind speed constant. The inclusion of cross-factors did not improve the regression analysis. Thus, the predictive equations (eqs 3 and 4) are:

$$\text{Log}_{10}(\text{evaporation rate}) = -0.15 + 0.00139^{*}\text{ air flow (/SLPM)} + 0.020^{*}\text{ drop mass (/mg)} + 0.030 * \text{temperature (°C)} + 0.11(\text{non-porous}) + 0.09\text{ (concrete)} + 1.06\text{ (GD)} + 0.53\text{ (TGD)} + 0.05(\text{H}) \quad (3)$$

$$\text{Log}_{10}(\text{evaporation rate}) = -0.16 + 0.17^{*}\text{ wind speed (ms}^{-1}) + 0.020^{*}\text{ drop mass (mg)} + 0.030 * \text{temperature (°C)} + 0.11(\text{non-porous}) + 0.09(\text{concrete}) + 1.06\text{ (GD)} + 0.53\text{ (TGD)} + 0.05(\text{H}) \quad (4)$$

The equation has adjustments for concrete, GD and TGD, all of which increase the rate over the base case, which is VX on sand. The equation also has adjustments for the non-porous and concrete substrates relative to the base case, which is sand. The rates analyzed were the initial evaporation rates; these rates cannot be extrapolated to find the time at which no agent is present, because during the evaporation process, the rates decrease as the agent is depleted (Figures 4, 5, and 12). Fortunately, the regression equations did not require the %vapor recovery to get a good r^2 value because the %vapor recovery would never be known in an operational scenario.

A plot of the observed versus predicted data are shown with different colors and shapes for the different agent-substrate combinations; the groupings of the various agent-substrate combinations are evident (Figure 26). As expected, the slope of the line is one, and the less-volatile VX tends to have a slower evaporation rate than the more volatile GD. The evaporation rates span five orders of magnitude, and agent identity is a greater variable than substrate.

4.4 Comparison of Time Taken to Reach 0.003 mg/m³ for VX and HD.

The vapor concentration of 0.003 mg/m^3 happens to be the IDLH for VX and the Short Term Exposure Limit (STEL) for sulfur mustard. The time required to reach a vapor concentration of 0.003 mg/m^3 was recorded for each sample, and expressed as a function of drop size, temperature, wind speed, substrate and agent. A total of 282 datapoints were available. The r^2 and r^2_{adj} were 0.70 (Figure 27a), and the residuals were randomly distributed (Figure 27b). The use of nominal rather than measured wind speeds and drop masses contributed to the scatter in the experimental data. The parameter estimates generated are summarized in Table 13, and the predictive equation (eq 5) is:

$$\text{Log}_{10}(\text{time to 0.003 mg/m}^3) = 3.56 - 0.24^{*}\text{ wind speed (/ms}^{-1}) + 0.049^{*}\text{ drop mass (/mg)} - 0.019 * \text{temperature (°C)} - 0.12(\text{glass}) - 0.05(\text{concrete}) - 0.29(\text{H} \quad (5)$$

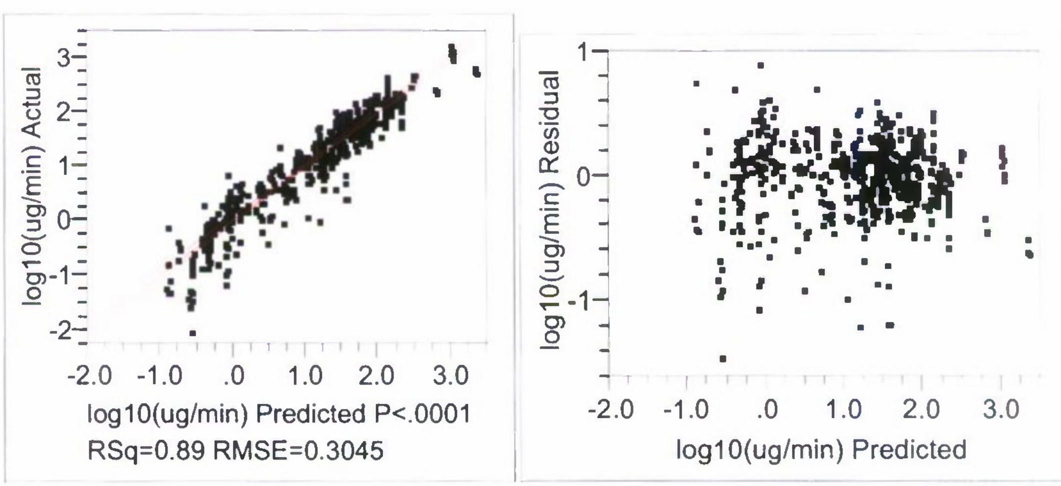
The same analysis was repeated with HD and VX separately. The r^2s were 0.74 and 0.85, respectively (Figure 28), indicating that a better regression was obtained when the agents were analyzed separately (Tables 14, 15).

The GD and TGD were not analyzed for the time taken to reach 0.003 mg/m^3 because the target concentration limits for STEL and IDLH were 0.0002 and 0.05 mg/m^3, respectively.

The predicted versus actual regression line (Figure 29) shows that there is a great deal of overlap between the HD and VX data; the HD times span from 0.5 to 3.5 log units (3 to 3200 min); whereas, the VX data cover 1.7 to 3.8 log units (50 to 6300 min), and longer times are more prevalent. The same data re-plotted to emphasize the clustering of the temperature data show that the temperature is an important variable (Figure 30), and that at lower temperatures, the VX would have even greater persistence. The ability to create a plot and a regression line for the time to reach STEL for sulfur mustard and IDLH for VX shows how guidance for the time at which one may remove a gas mask – a time of operational importance - may eventually be extracted from the wind tunnel data. The fit of the time taken to reach 0.003 mg/m^3 to one regression line also shows that the vapor concentration responded to the variations in temperature, air flow and drop size in a regular manner.

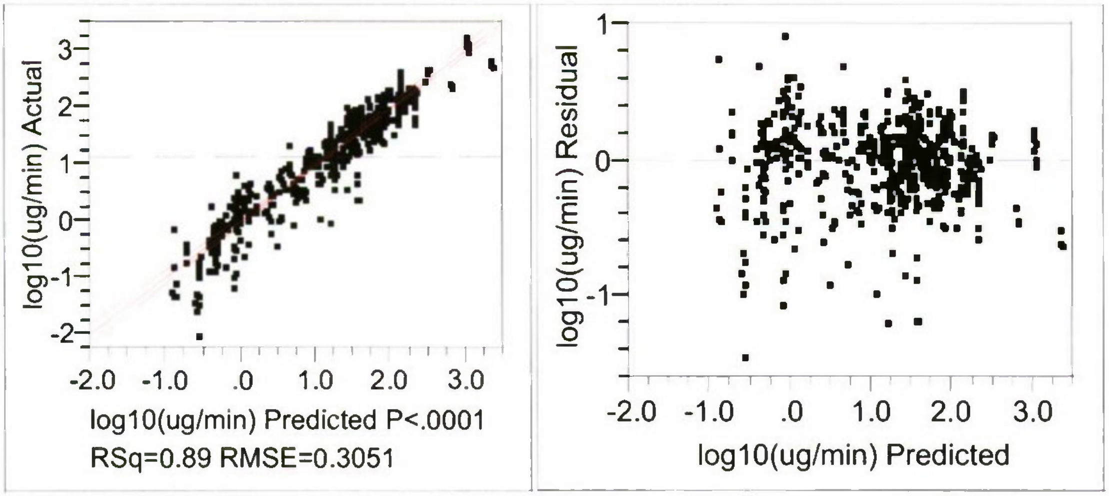
The vapor concentration for 20 out of 51 VX droplets on sand did not reach the 0.003 mg/m^3 threshold level but peaked at 0.002 mg/m^3. These samples were excluded from the analysis. One possible reason for the different maxima in vapor concentrations was slight variations in the size of the initial droplets, which were not weighed.

The vapor concentration for 18 out of 43 VX droplets on concrete did not reach the 0.003 mg/m^3; possible contributing factors are not only droplet size issues, but also the heterogeneity of the substrate: one droplet may penetrate deeply very quickly; whereas, another may spread more.



(a) (b)

Figure 24. Plot of (a) actual versus predicted $\log_{10}$(evaporation rate) (μg/min) and (b) residuals for all agents on all substrates using air flow rate (SLPM).



(a) (b)

Figure 25. Plot of (a) actual versus predicted $\log_{10}$(evaporation rate) (μg/min) and (b) residuals for all agents on all substrates using wind speed (m/s).

Table 12. Parameter Estimates for the Major Effects Contributing to the Log_{10}(evaporation rate) for H, HD, GD, TGD and VX on Glass, Stainless Steel, Sand and Concrete

	wind speed (m/s)			air flow rate (SLPM)		
Term	Estimate	Std Error	Prob>|t|	Estimate	Std Error	Prob>|t|
Intercept	-0.16	0.05	0.0008	-0.15	0.04	0.0016
Temperature (°C)	0.030	0.001	<0.0001	0.030	0.001	<0.0001
Wind Speed (ms^{-1})	0.17	0.01	<0.0001			
Air flow rate (SLPM)				0.00139	0.00009	<0.0001
Drop mass (mg)	0.020	0.002	<0.0001	0.020	0.002	<0.0001
Substrate[Concrete]	0.09	0.02	<0.0001	0.09	0.02	<0.0001
Substrate[non-porous]	0.11	0.02	<0.0001	0.11	0.02	<0.0001
Agent[GD]	1.06	0.03	<0.0001	1.06	0.03	<0.0001
Agent[H]	0.05	0.02	0.0134	0.05	0.02	0.0135
Agent[TGD]	0.53	0.03	<0.0001	0.53	0.03	<0.0001

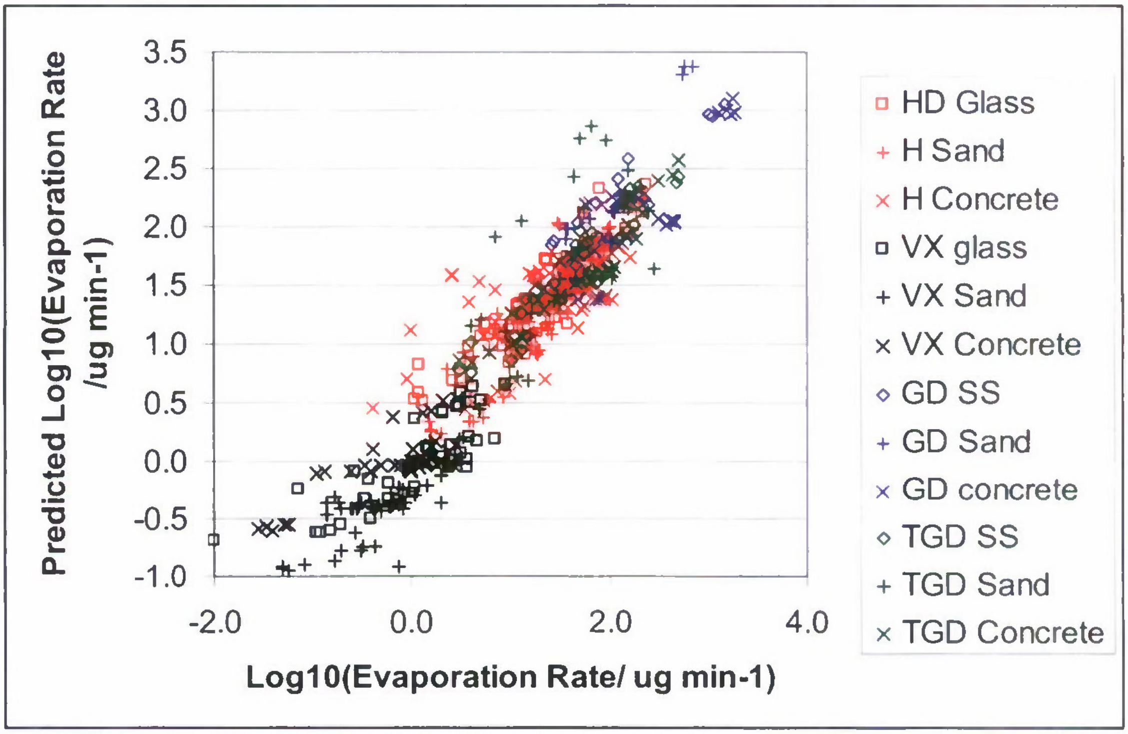
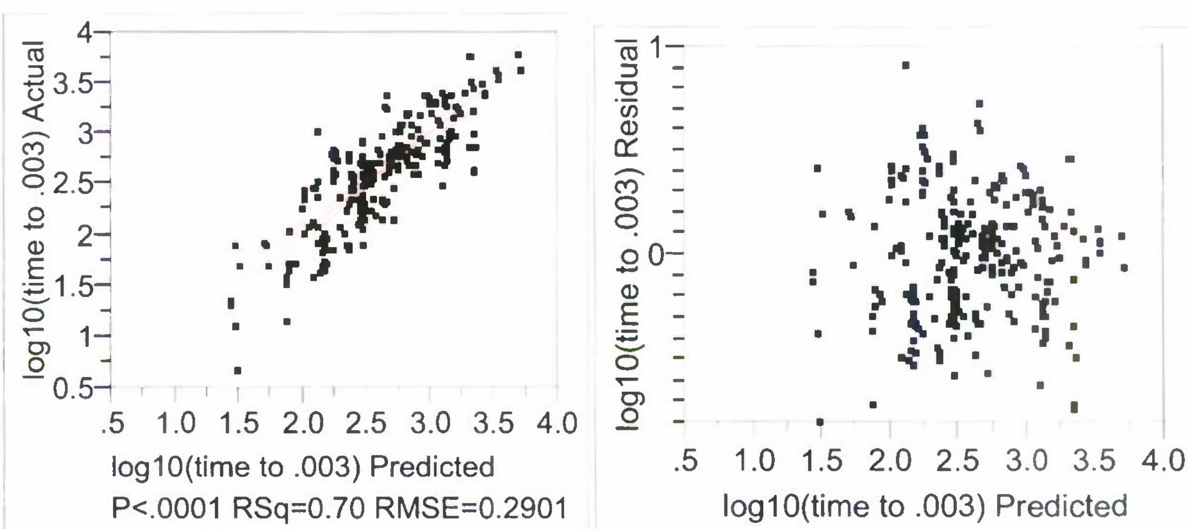


Figure 26. Plot of predicted versus actual $\log_{10}$(evaporation rate) for HD, H, GD, VX and TGD on glass, stainless steel, sand and concrete.



(a) (b)

Figure 27. Plot of (a) actual versus predicted $\log_{10}$(time to reach 0.003 mg/m^3) (min) and (b) residuals for HD and VX on glass, concrete and sand.

Table 13. Parameter Estimates for the Major Effects Contributing to the Log_{10}(time to 0.003 mg/m^3) for H, HD and VX on Sand, Glass and Concrete

Term	Estimate	Std Error	Prob>|t|
Intercept	3.56	0.08	<0.0001
Temperature (°C)	-0.019	0.001	<0.0001
Wind Speed, (ms^{-1})	-0.24	0.01	<0.0001
Drop size (mg)	0.049	0.005	<0.0001
Substrate[Concrete]	-0.05	0.03	0.0581
Substrate[glass]	-0.12	0.02	<0.0001
Agent[H]	-0.29	0.02	<0.0001

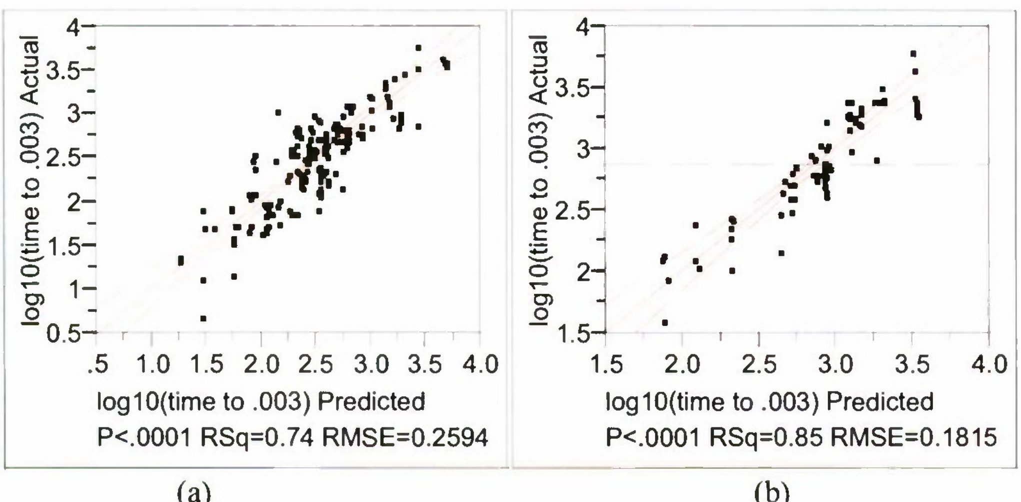


Figure 28. Plot of actual versus predicted log_{10}(time to reach 0.003 mg/m^3) (min) on glass, concrete and sand for (a) HD and (b) VX.

Table 14. Statistical Results for the Log_{10}(time to 0.003 mg/m^3) for Sulfur Mustard and VX on Sand, Glass and Concrete

	H, HD	VX	Combined
r^2	0.74	0.85	0.70
r^2_{adj}	0.74	0.84	0.69
Root Mean Square Error	0.26	0.18	0.29
Mean of Response	2.5	2.9	2.6
Observations	205.0	77.0	283.0

Table 15. Parameter Estimates for the Major Effects Contributing to the Log_{10}(time to 0.003 mg/m^3) for Sulfur Mustard and VX on Sand, Glass and Concrete, Analyzed Separately

	Sulfur Mustard			VX		
Term	Estimate	Std Error	Prob>|t|	Estimate	Std Error	Prob>|t|
Intercept	3.32	0.07	<0.0001	3.4	0.1	<0.0001
Temperature (°C)	-0.019	0.001	<0.0001	-0.01	0.003	<0.0001
Wind Speed (ms^{-1})	-0.27	0.02	<0.0001	-0.21	0.02	<0.0001
Drop size (mg)	0.052	0.006	<0.0001	0.077	0.006	<0.0001
Substrate[Concrete]			0.7854	-0.22	0.03	<0.0001
Substrate[glass]	-0.24	0.03	<0.0001	0.23	0.03	<0.0001

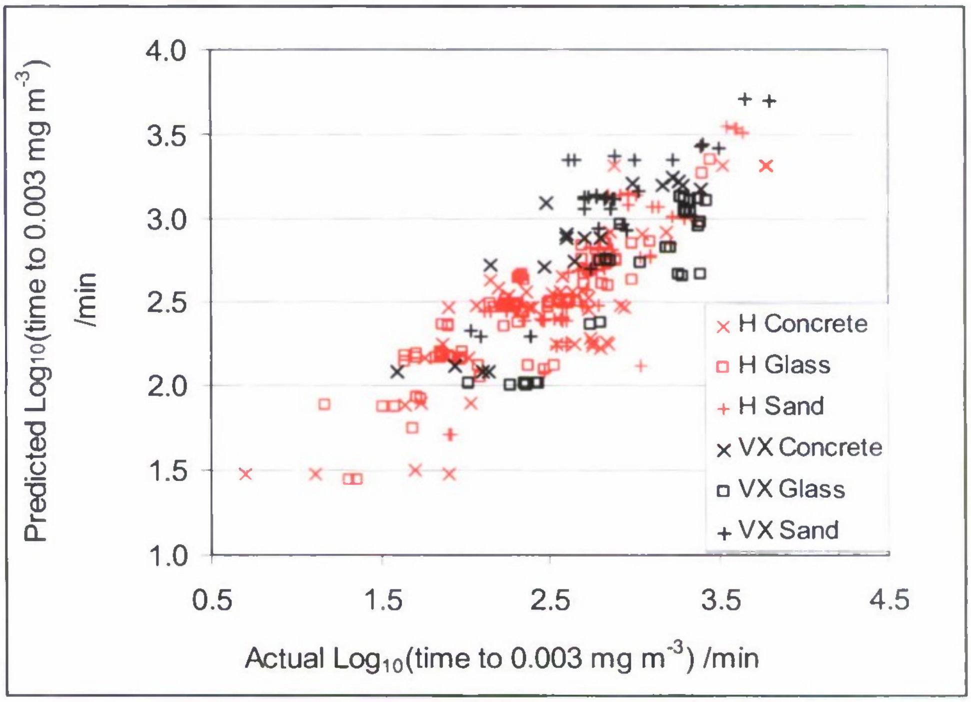


Figure 29. Plot of predicted versus actual $\log_{10}$(time to 0.003 mg m^{-3}) for HD, H and VX on glass, sand and concrete.

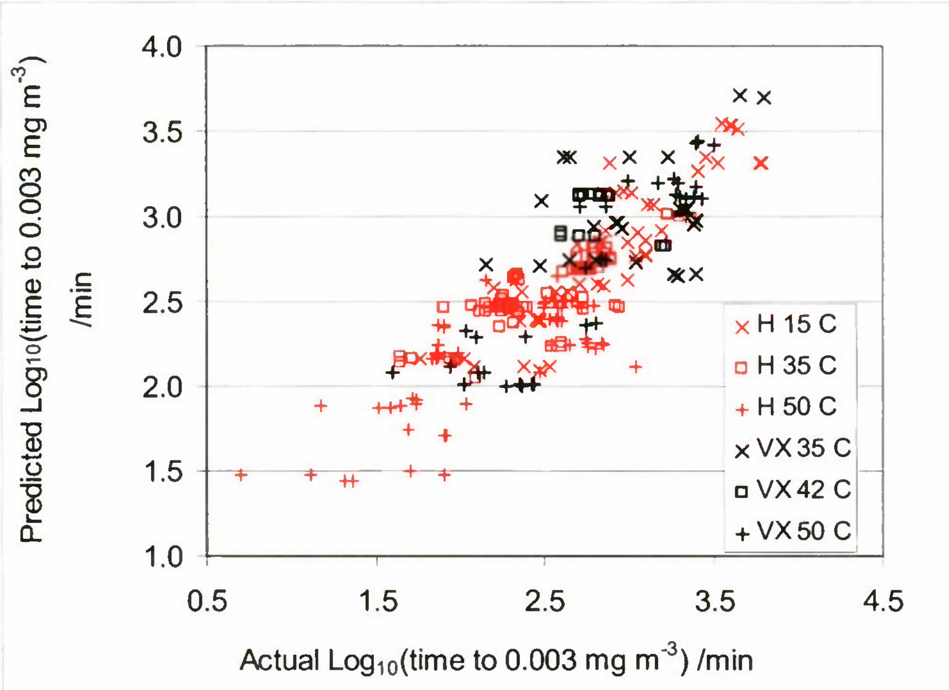


Figure 30. Plot of predicted versus actual $\log_{10}$(time to 0.003 mg m^{-3}) for HD and H at 15, 35 and 50 °C, and VX at 35, 42 and 50 °C, on glass, sand and concrete.

4.5 Percentage Recovery of Agent from Vapor and Solids.

The wind tunnels measured only the agent that evaporated, and extracts of the substrates showed how much non-evaporated agent was extracted from the substrate. For the GD and TGD, the %vapor recovery values based on the DAAMS tubes were ~100%; whereas, for the HD and H, the %vapor recovery values from the tunnels based on the DAAMS tubes were ~60 to 80%, even in situations where the cameras clearly showed that no more agent was present on the glass. One method of treating the data on glass was to normalize the evaporation curve to100%, based on the camera data. In the case of concrete, the rapid spread of agent over the surface in the first few minutes, before the wind tunnel data were collected, would lead to a lower %vapor recovery.

The VX recovery was tested by putting agent vapor directly into the wind tunnel, and the recovery was quantitative. Hence, the %VX vapor data were considered reliable. In fact, the low recovery and low extractability of VX from glass, sand and concrete indicated the existence of another loss mechanism. VX was shown to undergo degradation on the glass and sand; it was entrained in the concrete. Separate studies have shown that VX was unreactive in concrete on the time scale of evaporation. Separate studies of HD on concrete have also shown that it can remain unreacted within and non-extractable from concrete;[11] a similar phenomenon seems operative for VX on concrete.

The average amount of agent that evaporated, was extracted, and remained in the various substrates is shown in Table 16. The agent that did not evaporate may either degrade or

persist in the substrate. Independent NMR studies determined the degradation rates of the agents in the various substrates.

Table 16. Average %Agent Partitioning on Substrates

	Evaporated				Extracted				Remaining			
	GD	TGD	HD	VX	GD	TGD	HD	VX	GD	TGD	HD	VX
Glass or Steel	100	100	100	59	0	0.4	0	0	0	0	0	41[a]
Sand	94	99	75	11	4	5	9	10	0	0	14[b]	79[a]
Concrete	50	80	50	40	1	2	3[c]	2	49[d]	18[d]	47[e]	58[f]

[a]Degradation rates have been determined.[2]
[b]HD does not degrade in sand.[5]
[c]Only two data points, 0.1 and 5.5% were available.
[d]Fate of GD on concrete has not yet been fully elucidated.
[e]HD degrades on concrete over a period of 2 years.[7]
[f]VX degradation on concrete has a half-life of 96 days.[9]

4.6 Comparison of Relative Evaporation Rates to Agent Volatility and Vapor Pressure

The volatility of HD, GD and VX has been reported at a variety of temperatures.[11] The volatilities of HD and VX were 1975 and 34 mg/m^3 at 35 °C; 5647 and 134 mg/m^3 at 50 °C; yielding HD/VX ratios of 57.9 and 42.1 at 35 and 50 °C, respectively.[12] Evaporation rates of HD and VX were measured at 35 and 50 °C on the same substrates, with the same air flow rates and drop sizes; thus, the HD/VX ratios could be calculated (Table 17) and compared to the volatility ratios. The experimental HD/VX ratios (Table 17) were of the same order of magnitude as the calculated ratios, averaging 43 and 32 at 35 and 50 °C, respectively, but it remains to be determined why one environmental condition would give a higher ratio than another would.

Table 17. HD/VX Evaporation Rate Ratios

Temperature (°C)	Air Flow (SLPM)	Drop size (µL)	Substrate	Evaporation Rate VX (µg min^{-1})	Evaporation Rate HD (µg min^{-1})	HD/VX Evaporation Rate ratio
35.0	406.0	9.0	glass	2.0	60.0	30.0
35.0	406.0	9.0	sand	1.0	37.0	37.0
35.0	18.0	9.0	sand	0.3	19.0	63.0
35.0	182.0	6.0	glass	0.9	37.0	41.0
50.0	405.0	1.0	glass	3.0	64.0	21.0
50.0	405.0	1.0	sand	3.0	32.0	11.0
50.0	405.0	9.0	glass	6.0	214.0	37.0
50.0	405.0	9.0	sand	3.0	99.0	33.0
50.0	18.0	9.0	glass	2.0	60.0	30.0
50.0	18.0	9.0	sand	0.6	35.0	58.0

5. CONCLUSIONS

When droplets of VX were placed on substrates, the VX vapors emanating from the sand and concrcte substrates were initially above the OSHA Immediately Dangerous to Life and Health (IDLH) limit of 3×10^{-3} mg/m^3, and the Short-Term Exposure Limit (STEL) of 1×10^{-5} mg/m^3.[10] The time taken for VX to reach the IDLH depended upon the substrate chosen, wind speed, and drop size, and ranged from 50 to 6300 min. Trends were observed in the evaporation rates based on the laboratory-made concrete samples that had variable water-to-cement ratios, but the range of evaporation rates from the standard CZ04 concrete was sufficiently large that the trends within the laboratory-made concrete samples were minor by comparison.

One regression line for the $\log_{10}$(evaporation rate) of the agents VX, HD, GD and TGD on the substrates glass, steel, sand (3 types) and concrete (5 types) as a function of temperature, droplet size, air flow and %vapor recovered was generated. The data werc segregated according to the type of agent, and spanned a range of 6 orders of magnitude. At one point in the project, the goal was to study the effect of a variety of sand and concrete surfaces on the evaporation rate. Current data suggest that a limited number of experiments may be used to determine the relative coefficient for each substrate-agent combination, and this coefficient may be applied to a wide range of temperatures and wind speeds.

The time required to reach STEL for sulfur mustard and IDLH for VX could be expressed as a function of wind speed, temperature and drop size, with adjustment factors for the substrate.

When the data were examined in detail on a per agent basis, minor differences in the regression line as a function of temperature, droplet size, air flow and %vapor recovered were seen. The influence of cross factors on the evaporation rates was determined for VX on sand; insufficient data was available for VX on concrete. The cross factors were minor contributors to the overall evaporation rate trends.

6. FUTURE WORK

When the program was initially conceived, the substrates were considered non-porous, non-reactive; porous, non-reactive; and porous, reactive.[13] At the current point in this project, along with observations from other projects, the substrates may be viewed differently: porous vs. non-porous; high initial spreading of agent vs. the agent beading on the surface; absorption vs. repellency of the agent; reactive vs. non-reactive. HD was observed to be relatively non-reactive on all of the surfaces studied (cxcept some concretes); VX degraded based upon the amount of water present, at a rate that was often independent of the surface on which it was placed.[2,14]

All of the agents studied adsorbed into the sand immediately and spread across the surface of the concrete within seconds before adsorbing. HD formed a bead on glass; whereas, VX had a tendency to spread. The initial vapor concentration depended upon the

surface area of the agent. Thus, the initial vapor concentration obtained from a non-porous surface depended upon the degree to which the agent spread, or beaded, on that particular surface.

Suggestions for future projects follow:

- Study the evaporation rates and %agent retained on soils. Vary the composition of the soil, especially the identity and quantity of the clay components, some of which are known to absorb agent.

- Analyze the evaporation rate data generated in this study in combination with prior studies on agent and simulants on a variety of surfaces and with the recently collected agent evaporation data from wind tunnels.

- Study the effect of a variety of substrates on the evaporation rate of an agent at a specific temperature, drop size and wind speed; generate a coefficient for each substrate.

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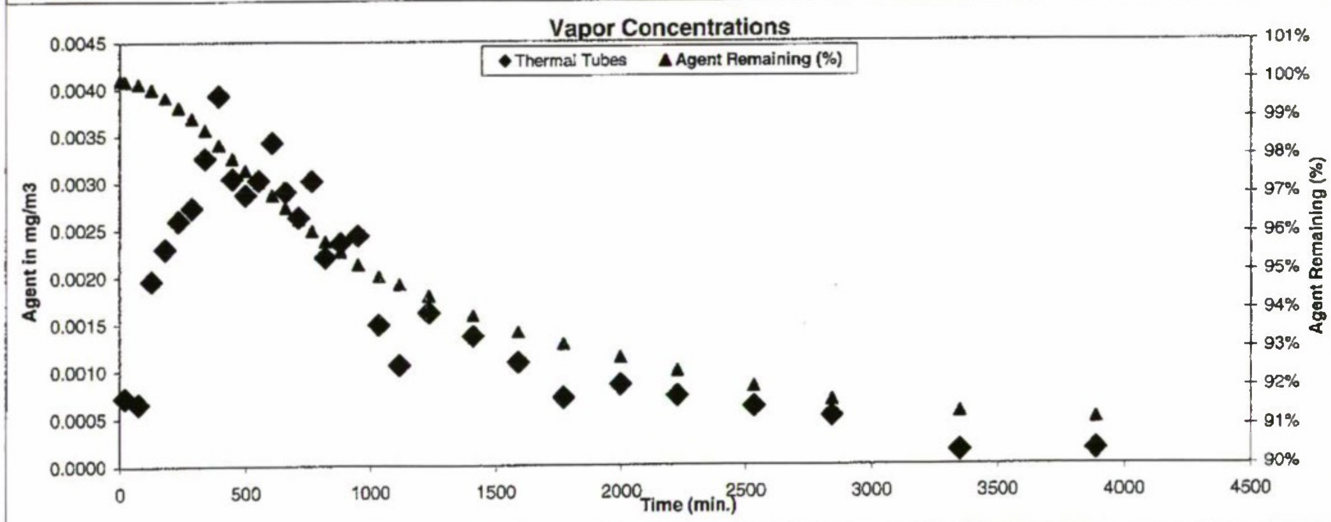
APPENDIX A

VX ON SAND WIND TUNNEL DATA

15. 20070108_3c_187(---_a_1)VXtc_Suk.xls

Data Evaluation Grade: Test Grade (requires further evaluation)

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	01/08/07	187
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	33.76 °C	
Average air flow rate:	18.03 SLPM	
Average air temperature above drop:	34.85 °C	
Mass % recovery in vapor:	8.8 %	
Mass % recovery by extraction:	8.2 %	
Total agent % mass recovery:	17.0 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.057 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

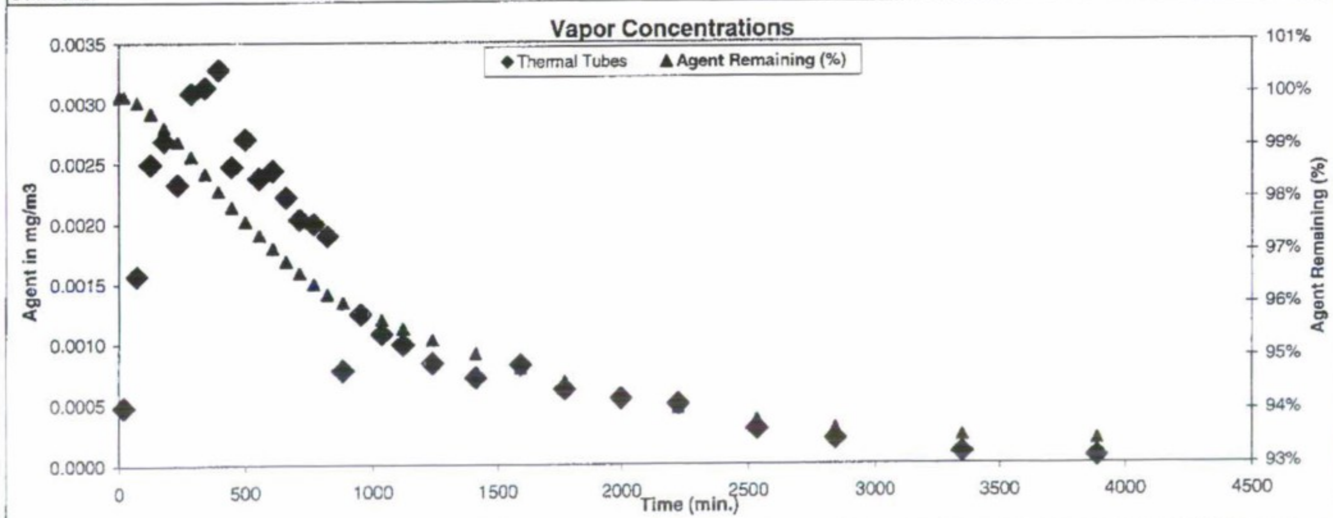


Time (min)	Conc. mg/m^3	Agent rem. (%)
18.88	7.20E-04	99.99%
72.25	6.57E-04	99.91%
125.63	1.96E-03	99.78%
179.02	2.30E-03	99.55%
232.40	2.60E-03	99.30%
285.76	2.73E-03	99.02%
339.15	3.26E-03	98.71%
392.53	3.93E-03	98.33%
445.90	3.04E-03	97.96%
499.28	2.87E-03	97.65%
552.66	3.02E-03	97.35%
606.05	3.43E-03	97.01%
659.42	2.90E-03	96.68%
712.80	2.63E-03	96.39%
766.18	3.02E-03	96.09%
819.56	2.21E-03	95.82%
881.28	2.36E-03	95.54%
951.32	2.44E-03	95.21%
1034.70	1.49E-03	94.89%
1118.08	1.06E-03	94.68%
1234.80	1.62E-03	94.38%
1409.83	1.36E-03	93.87%
1589.88	1.08E-03	93.43%
1769.93	7.09E-04	93.12%
1996.63	8.45E-04	92.77%
2223.35	7.27E-04	92.42%
2533.40	6.13E-04	92.01%
2843.45	5.08E-04	91.67%
3350.15	1.43E-04	91.35%
3886.87	1.56E-04	91.19%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	01/08/07	150
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	1	µL
Mass of agent disseminated:	1.01	mg
Corrected mass on 100% agent purity:	0.92	mg
Average substrate temperature:	34.55	°C
Average air flow rate:	18.07	SLPM
Average air temperature above drop:	34.67	°C
Mass % recovery in vapor:	6.5	%
Mass % recovery by extraction:	7.8	%
Total agent % mass recovery:	14.3	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.050 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
19.13	4.79E-04	99.99%
72.50	1.57E-03	99.88%
125.88	2.50E-03	99.67%
179.26	2.69E-03	99.40%
232.65	2.33E-03	99.14%
286.03	3.09E-03	98.85%
339.41	3.13E-03	98.53%
392.80	3.28E-03	98.19%
446.18	2.47E-03	97.89%
499.57	2.71E-03	97.61%
552.93	2.38E-03	97.35%
606.31	2.44E-03	97.10%
659.70	2.22E-03	96.85%
713.08	2.03E-03	96.63%
766.46	2.00E-03	96.42%
819.85	1.89E-03	96.21%
881.57	7.75E-04	96.05%
951.62	1.24E-03	95.91%
1035.00	1.07E-03	95.72%
1118.38	9.86E-04	95.55%
1235.10	8.34E-04	95.34%
1410.13	7.11E-04	95.08%
1590.18	8.16E-04	94.81%
1770.23	6.14E-04	94.56%
1996.95	5.40E-04	94.30%
2223.67	4.93E-04	94.07%
2533.72	2.88E-04	93.83%
2843.77	2.05E-04	93.68%
3350.48	9.25E-05	93.53%
3887.20	5.63E-05	93.45%

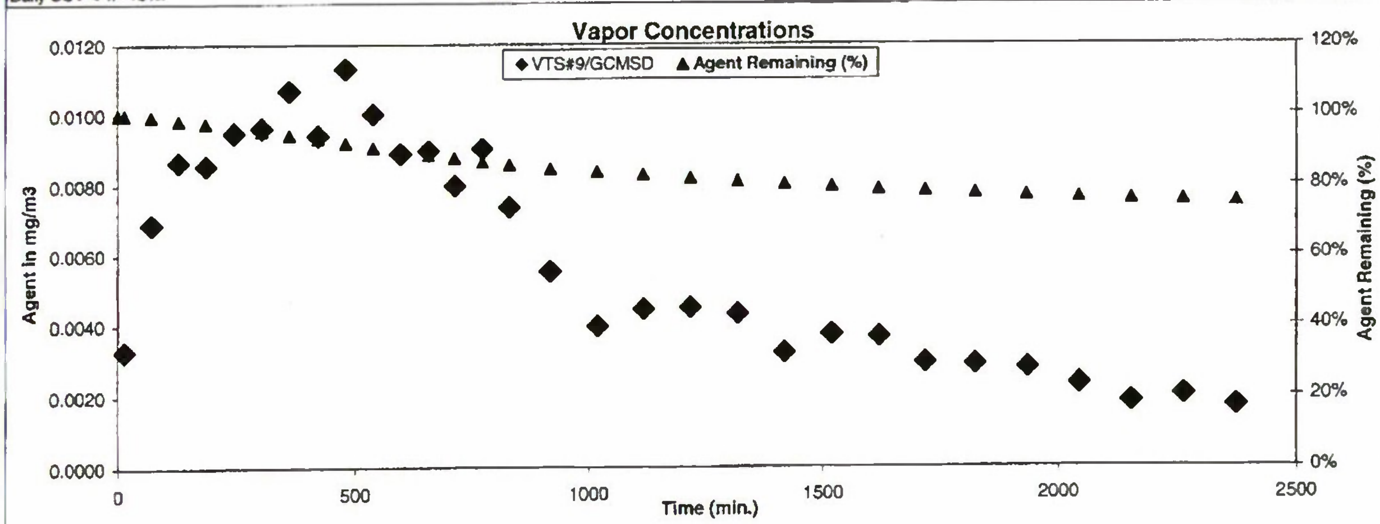
2 Copy of 20061010_3c_176(---_a_1)VX_Suk.xls

Data Evaluation Grade: **Test Grade (requires further evaluation)**

Tunnel:	3c
Instruments:	VTS#9 GCMSD
Date/Experiment #:	10/10/06 178
Type of substrate :	UK Sand
Test agent:	VX
Agent purity:	91.0% ite/Chem: KS
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	34.73 °C
Average air flow rate:	18.12 SLPM
Average air temperature above drop:	34.89 °C
Mass % recovery in vapor:	24.9 %
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	24.9 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes

Raw evaporation rate: 0.17 µg/min

Time (min)	Conc. mg/m³	Agent rem. (%)
13.98	3.27E-03	99.95%
72.35	6.89E-03	99.37%
130.73	8.65E-03	98.48%
189.12	8.54E-03	97.49%
247.48	9.49E-03	96.45%
305.87	9.62E-03	95.35%
364.25	1.07E-02	94.18%
422.63	9.40E-03	93.03%
481.00	1.13E-02	91.84%
539.38	1.00E-02	90.61%
597.77	8.88E-03	89.52%
656.15	8.97E-03	88.50%
714.52	7.99E-03	87.52%
772.90	9.02E-03	86.54%
831.28	7.37E-03	85.60%
918.83	5.53E-03	84.49%
1018.88	3.96E-03	83.55%
1118.92	4.43E-03	82.72%
1218.97	4.48E-03	81.84%
1319.02	4.30E-03	80.98%
1419.07	3.20E-03	80.24%
1519.10	3.71E-03	79.56%
1619.15	3.65E-03	78.83%
1719.20	2.92E-03	78.18%
1824.25	2.87E-03	77.58%
1934.28	2.77E-03	76.97%
2044.33	2.34E-03	76.42%
2154.38	1.83E-03	75.97%
2264.42	2.02E-03	75.55%
2374.47	1.71E-03	75.14%

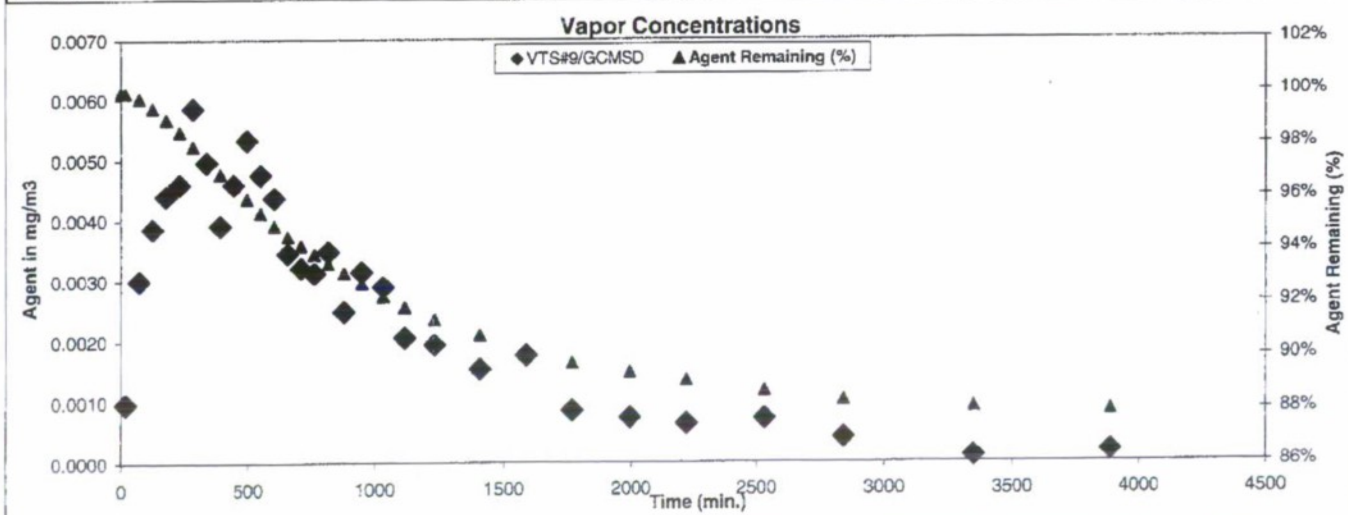


2 Copy of 20061016_3c_177(---_a_2)VX_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#9/GCMSD
Date/Experiment #:	10/16/06 177
Type of substrate :	UK Sand
Test agent/purity:	VX 91.0%
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	35.01 °C
Average air flow rate:	18.13 SLPM
Average air temperature above drop:	35.28 °C
Mass % recovery in vapor:	12.1 %
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	12.1 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.084 µg/min

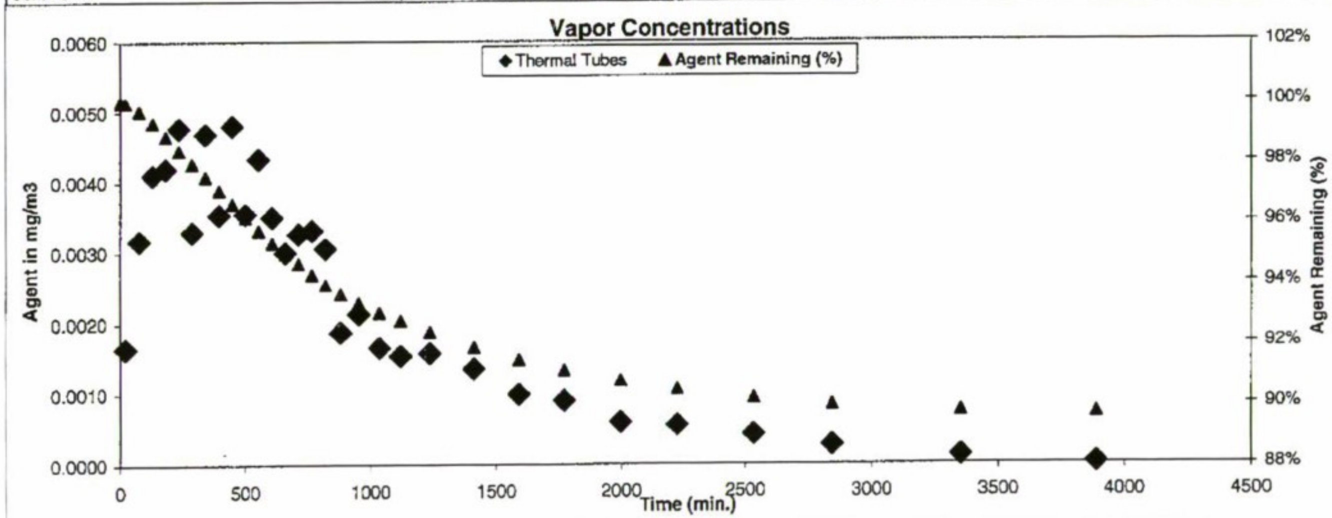


Time (min)	Conc. mg/m^3	Agent rem. (%)
17.80	9.73E-04	99.98%
71.18	3.00E-03	99.77%
124.57	3.86E-03	99.41%
177.93	4.40E-03	98.98%
231.32	4.60E-03	98.50%
284.70	5.86E-03	97.95%
338.07	4.96E-03	97.38%
391.45	3.91E-03	96.92%
444.83	4.59E-03	96.47%
498.20	5.33E-03	95.95%
551.58	4.75E-03	95.42%
604.97	4.37E-03	94.94%
658.35	3.44E-03	94.52%
711.72	3.20E-03	94.17%
765.10	3.12E-03	93.84%
818.48	3.47E-03	93.49%
880.20	2.48E-03	93.13%
950.23	3.13E-03	92.74%
1033.62	2.89E-03	92.25%
1117.00	2.06E-03	91.84%
1233.72	1.94E-03	91.38%
1408.75	1.54E-03	90.78%
1588.80	1.76E-03	90.20%
1768.85	8.50E-04	89.73%
1995.55	7.28E-04	89.38%
2222.27	6.28E-04	89.08%
2532.32	7.14E-04	88.67%
2842.37	4.00E-04	88.33%
3349.07	9.61E-05	88.08%
3885.78	1.76E-04	87.93%

Data Evaluation Grade: Not for Modeling

Tunnel:	3L
Instruments:	VTS#10/GCMSD
Date/Experiment #:	01/08/07 45
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	34.60 °C
Average air flow rate:	18.61 SLPM
Average air temperature above drop:	35.15 °C
Mass % recovery in vapor:	10.3 %
Mass % recovery by extraction:	7.6 %
Total agent % mass recovery:	17.9 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	Multiple drops on surface - initial drop volume for each unknown test grade

Raw evaportation rate: 0.75 µg/min

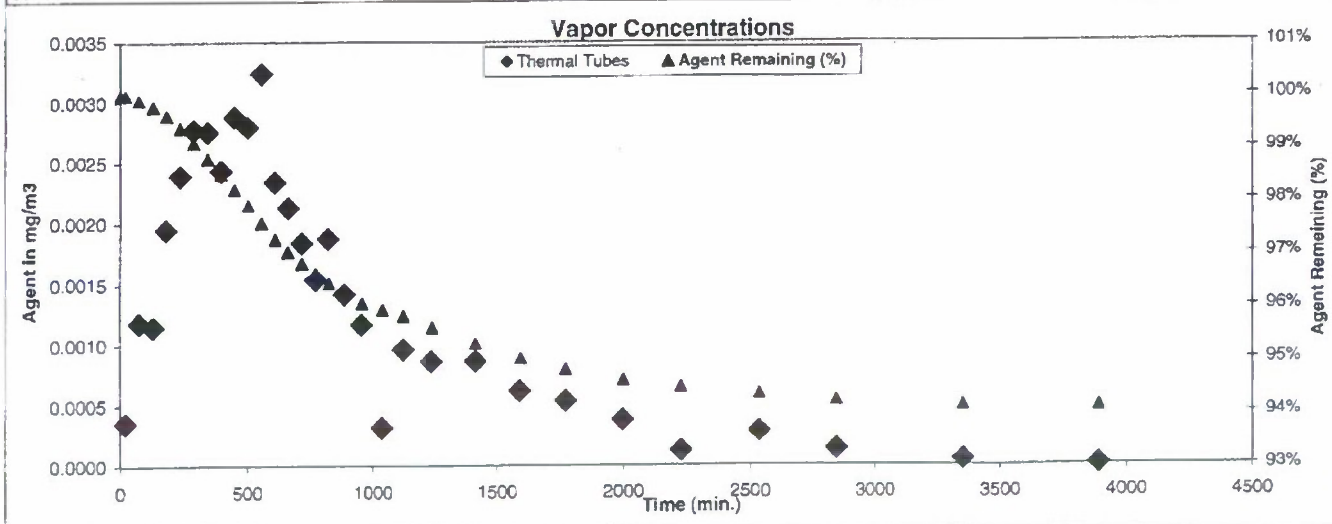


Time (min)	Conc. mg/m^3	Agent rem. (%)
19.87	1.64E-03	99.97%
73.25	3.17E-03	99.71%
126.63	4.10E-03	99.31%
180.02	4.19E-03	98.87%
233.40	4.77E-03	98.38%
286.78	3.29E-03	97.95%
340.16	4.69E-03	97.51%
393.55	3.53E-03	97.07%
446.93	4.80E-03	96.62%
500.31	3.55E-03	96.17%
553.70	4.33E-03	95.74%
607.08	3.50E-03	95.32%
660.45	3.00E-03	94.97%
713.83	3.26E-03	94.63%
767.21	3.31E-03	94.27%
820.62	3.05E-03	93.93%
882.33	1.87E-03	93.62%
952.38	2.13E-03	93.34%
1035.75	1.66E-03	93.02%
1119.13	1.54E-03	92.75%
1235.85	1.57E-03	92.38%
1410.90	1.35E-03	91.86%
1590.95	9.86E-04	91.43%
1771.00	8.98E-04	91.09%
1997.72	5.92E-04	90.75%
2224.43	5.53E-04	90.49%
2534.48	4.21E-04	90.18%
2844.53	2.67E-04	89.97%
3351.25	1.19E-04	89.77%
3887.97	1.22E-05	89.70%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3K
Instruments:	VTS#11/GCMSD
Date/Experiment #:	01/08/07 47
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	35.26 °C
Average air flow rate:	18.77 SLPM
Average air temperature above drop:	35.07 °C
Mass % recovery in vapor:	5.9 %
Mass % recovery by extraction:	7.1 %
Total agent % mass recovery:	13.0 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.050 µg/min

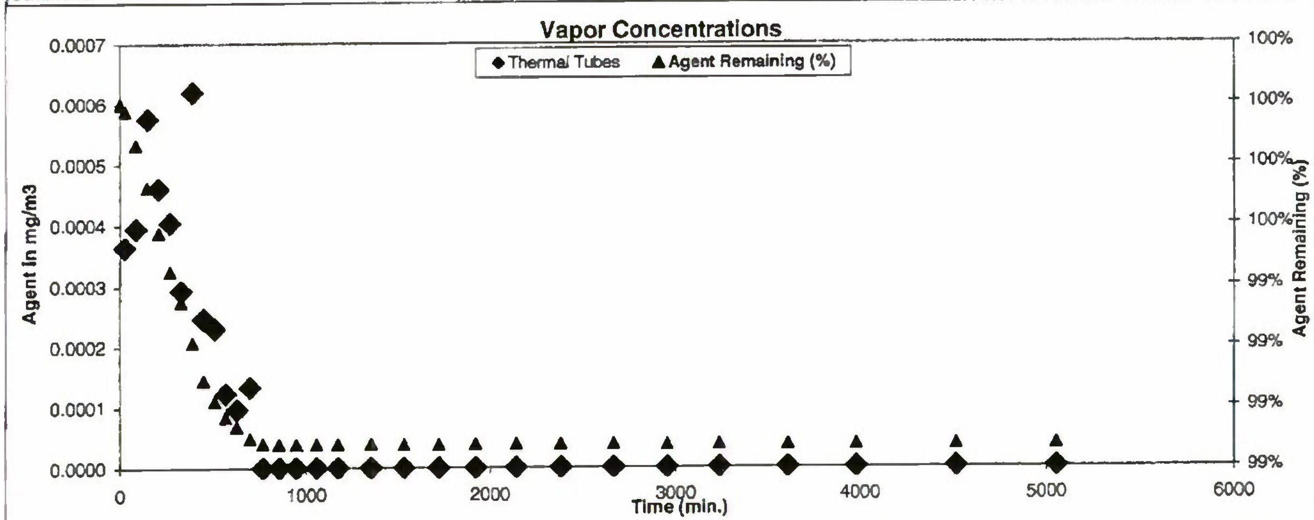


Time (min)	Conc. mg/m³	Agent rem. (%)
21.68	3.55E-04	99.99%
75.06	1.18E-03	99.91%
128.45	1.15E-03	99.78%
181.83	1.95E-03	99.61%
235.22	2.39E-03	99.38%
288.60	2.77E-03	99.10%
341.98	2.76E-03	98.79%
395.37	2.43E-03	98.51%
448.75	2.88E-03	98.22%
502.13	2.80E-03	97.91%
555.52	3.24E-03	97.58%
608.90	2.34E-03	97.28%
662.28	2.13E-03	97.03%
715.66	1.84E-03	96.82%
769.05	1.54E-03	96.63%
822.43	1.87E-03	96.45%
884.15	1.42E-03	96.24%
954.20	1.17E-03	96.06%
1037.58	3.15E-04	95.93%
1120.97	9.58E-04	95.82%
1237.68	8.65E-04	95.60%
1412.73	8.63E-04	95.30%
1592.78	6.18E-04	95.02%
1772.83	5.33E-04	94.81%
1999.53	3.79E-04	94.60%
2226.25	1.18E-04	94.49%
2536.30	2.80E-04	94.36%
2846.35	1.32E-04	94.23%
3353.07	4.42E-05	94.14%
3889.78	4.52E-06	94.11%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#8/GCMSD
Date/Experiment #:	10/19/06 141
Type of substrate :	UKSand
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	34.41 °C
Average air flow rate:	400.66 SLPM
Average air temperature above drop:	34.63 °C
Mass % recovery in vapor:	1.1 %
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	1.1 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	Flow not very steady

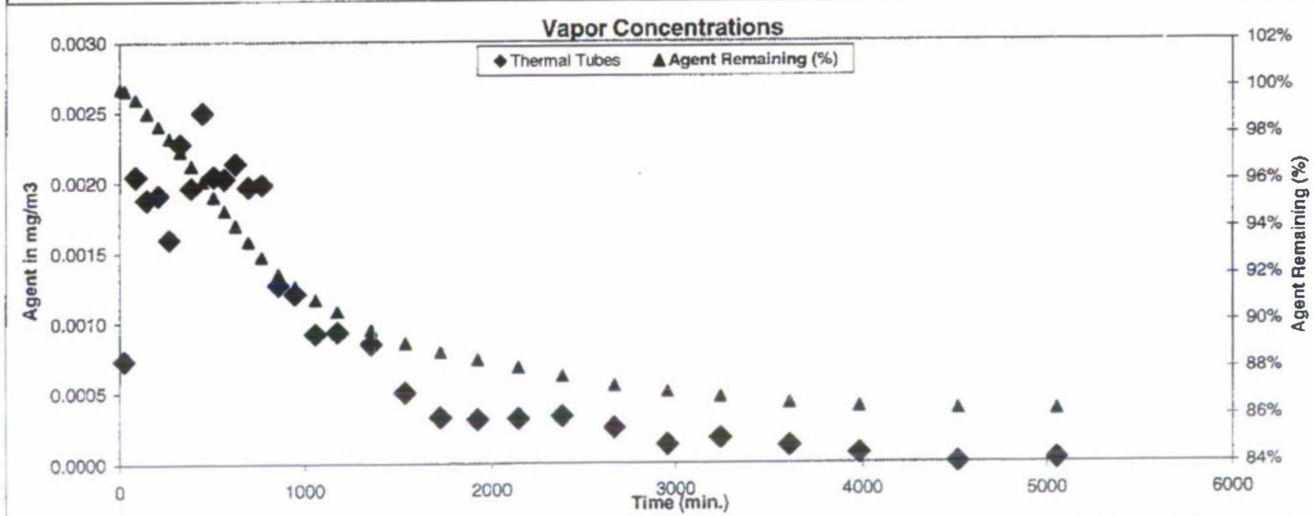
Raw evaporation rate: 0.17 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
26.05	3.64E-04	99.98%
86.10	3.95E-04	99.87%
146.15	5.75E-04	99.73%
206.20	4.61E-04	99.57%
266.25	4.05E-04	99.45%
326.30	2.92E-04	99.35%
386.35	6.21E-04	99.21%
446.40	2.46E-04	99.09%
506.43	2.30E-04	99.02%
566.48	1.22E-04	98.97%
626.53	9.64E-05	98.94%
696.58	1.32E-04	98.90%
766.63	0.00E+00	98.88%
856.68	0.00E+00	98.88%
946.73	0.00E+00	98.88%
1056.78	0.00E+00	98.88%
1171.83	0.00E+00	98.88%
1351.88	0.00E+00	98.88%
1531.93	0.00E+00	98.88%
1721.98	0.00E+00	98.88%
1922.02	0.00E+00	98.88%
2142.07	0.00E+00	98.88%
2382.12	0.00E+00	98.88%
2668.83	0.00E+00	98.88%
2955.55	0.00E+00	98.88%
3242.27	0.00E+00	98.88%
3612.32	0.00E+00	98.88%
3982.37	0.00E+00	98.88%
4519.08	0.00E+00	98.88%
5055.78	0.00E+00	98.88%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3c	
Instruments:	VTS#9/GCMSD	
Date/Experiment #:	10/19/06	178
Type of substrate :	UK Sand	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	34.65 °C	
Average air flow rate:	404.33 SLPM	
Average air temperature above drop:	34.77 °C	
Mass % recovery in vapor:	13.8 %	
Mass % recovery by extraction:	n/a %	
Total agent % mass recovery:	13.8 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.82 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	Flow not real steady	

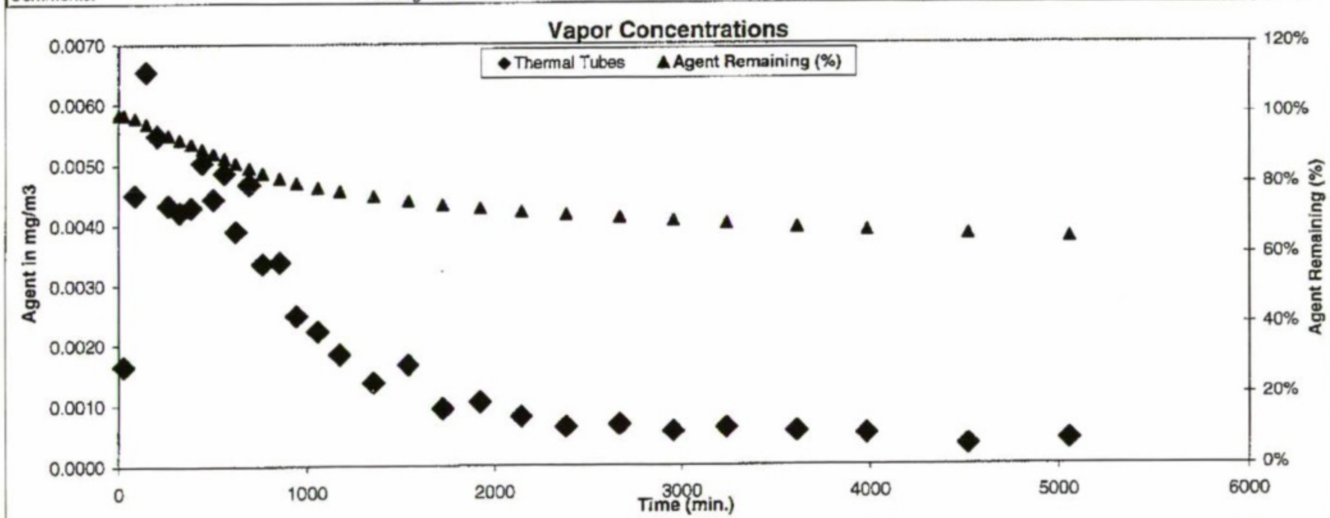


Time (min)	Conc. mg/m³	Agent rem. (%)
26.25	7.29E-04	99.95%
86.28	2.04E-03	99.55%
146.33	1.88E-03	98.97%
206.38	1.91E-03	98.41%
266.43	1.60E-03	97.90%
326.47	2.27E-03	97.33%
386.52	1.96E-03	96.71%
446.57	2.50E-03	96.06%
506.62	2.04E-03	95.39%
566.65	2.03E-03	94.79%
626.70	2.13E-03	94.18%
696.75	1.97E-03	93.48%
766.78	1.99E-03	92.80%
856.83	1.27E-03	92.09%
946.88	1.21E-03	91.54%
1056.93	9.18E-04	90.97%
1171.98	9.28E-04	90.45%
1352.03	8.44E-04	89.67%
1532.07	4.98E-04	89.08%
1722.12	3.23E-04	88.70%
1922.17	3.08E-04	88.39%
2142.20	3.14E-04	88.06%
2382.25	3.32E-04	87.68%
2668.97	2.49E-04	87.27%
2955.68	1.30E-04	87.01%
3242.38	1.75E-04	86.79%
3612.43	1.19E-04	86.53%
3982.48	6.58E-05	86.36%
4519.18	1.14E-06	86.27%
5055.90	2.42E-05	86.24%

Data Evaluation Grade: Not for modeling

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	01/25/07 191
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	36.09 °C
Average air flow rate:	404.85 SLPM
Average air temperature above drop:	35.62 °C
Mass % recovery in vapor:	35.3 %
Mass % recovery by extraction:	21.6 %
Total agent % mass recovery:	57.0 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	Although Flow stdev is outside of limits, the %stdev is still below 1%

Raw evaporation rate: 2 µg/min



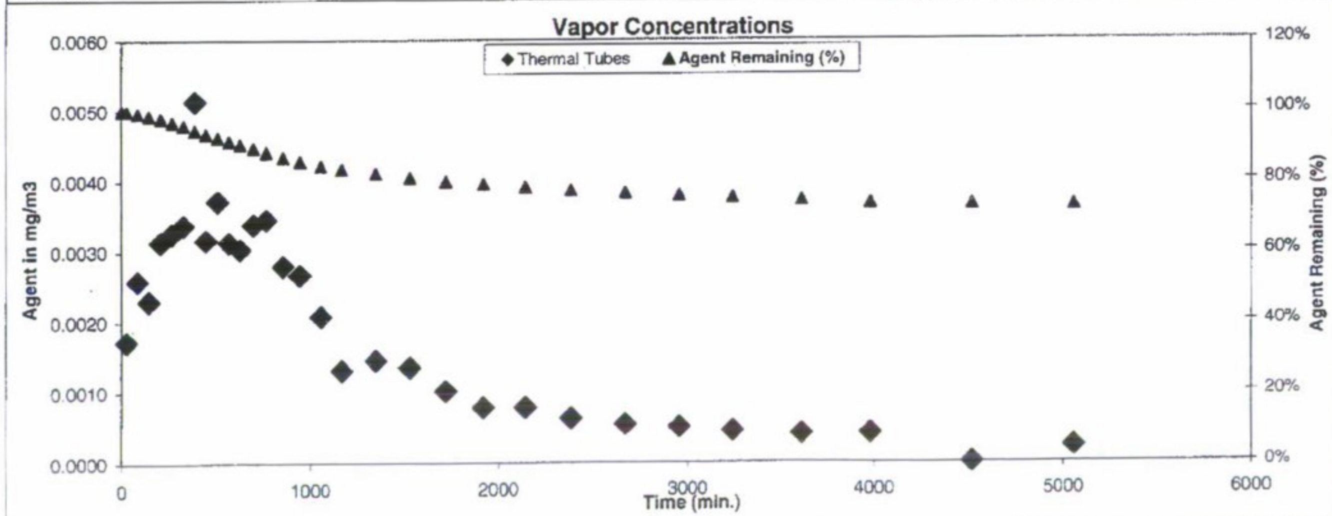
Time (min)	Conc. mg/m³	Agent rem. (%)
26.40	1.65E-03	99.89%
86.43	4.51E-03	98.99%
146.48	6.55E-03	97.36%
206.53	5.48E-03	95.60%
266.58	4.34E-03	94.15%
326.62	4.22E-03	92.90%
386.67	4.30E-03	91.64%
446.72	5.03E-03	90.27%
506.75	4.43E-03	88.88%
566.80	4.87E-03	87.51%
626.85	3.90E-03	86.23%
696.90	4.68E-03	84.76%
766.93	3.35E-03	83.38%
856.98	3.38E-03	81.89%
947.03	2.49E-03	80.60%
1057.08	2.23E-03	79.33%
1172.13	1.84E-03	78.18%
1352.17	1.37E-03	76.77%
1532.22	1.67E-03	75.43%
1722.27	9.43E-04	74.22%
1922.32	1.05E-03	73.24%
2142.35	8.09E-04	72.24%
2382.40	6.32E-04	71.39%
2669.12	6.73E-04	70.48%
2955.83	5.56E-04	69.62%
3242.53	6.15E-04	68.80%
3612.58	5.58E-04	67.73%
3982.63	5.12E-04	66.77%
4519.33	3.27E-04	65.66%
5056.05	4.19E-04	64.68%

5 Copy of 20070125_3a_154(-++_a_1)VXtc_Suk-NFM.xls

Data Evaluation Grade: **Not for modeling**

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	01/25/07 154
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	34.32 °C
Average air flow rate:	405.39 SLPM
Average air temperature above drop:	35.14 °C
Mass % recovery in vapor:	27.3 %
Mass % recovery by extraction:	26.9 %
Total agent % mass recovery:	54.2 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

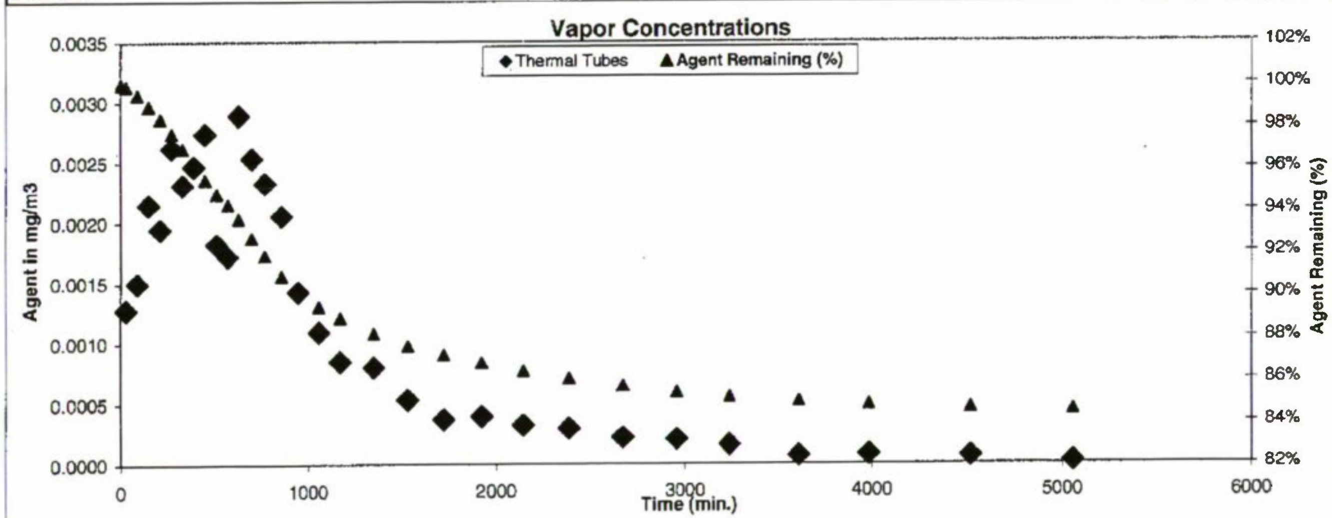
Raw evaporation rate: 1.4µg/min



Time (min)	Conc. mg/m³	Agent rem. (%)
26.45	1.72E-03	99.89%
86.50	2.58E-03	99.26%
146.53	2.29E-03	98.54%
206.58	3.13E-03	97.74%
266.63	3.26E-03	96.80%
326.68	3.38E-03	95.82%
386.73	5.13E-03	94.57%
446.78	3.16E-03	93.35%
506.83	3.72E-03	92.34%
566.88	3.13E-03	91.33%
626.92	3.03E-03	90.42%
696.97	3.38E-03	89.32%
767.02	3.45E-03	88.15%
857.07	2.79E-03	86.77%
947.12	2.67E-03	85.57%
1057.17	2.07E-03	84.29%
1172.22	1.30E-03	83.34%
1352.27	1.45E-03	82.12%
1532.32	1.35E-03	80.89%
1722.37	1.01E-03	79.79%
1922.42	7.81E-04	78.91%
2142.47	7.78E-04	78.07%
2382.50	6.24E-04	77.25%
2669.22	5.38E-04	76.43%
2955.93	4.97E-04	75.70%
3242.65	4.44E-04	75.04%
3612.70	4.02E-04	74.28%
3982.75	4.14E-04	73.54%
4519.47	0.00E+00	72.99%
5056.18	2.24E-04	72.70%

Data Evaluation Grade: Modeling Grade

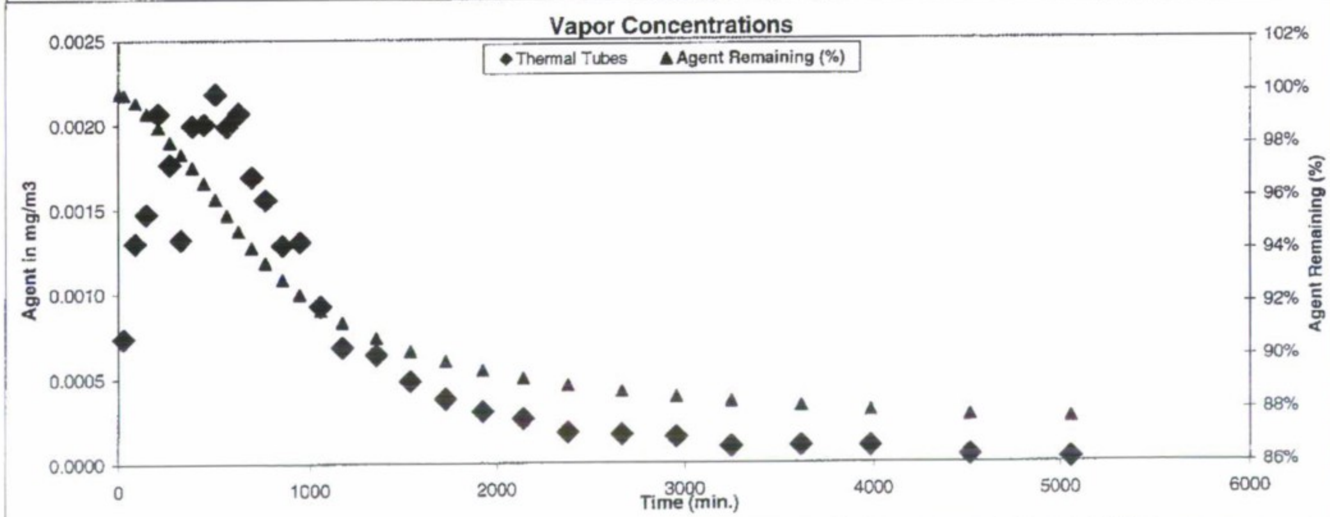
Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	01/18/07	48
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	35.39 °C	
Average air flow rate:	405.43 SLPM	
Average air temperature above drop:	35.69 °C	
Mass % recovery in vapor:	15.5 %	
Mass % recovery by extraction:	18.3 %	
Total agent % mass recovery:	33.8 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.94 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	



Time (min)	Conc. mg/m^3	Agent rem. (%)
26.80	1.28E-03	99.92%
86.85	1.50E-03	99.51%
146.90	2.15E-03	98.97%
206.95	1.95E-03	98.37%
267.00	2.62E-03	97.69%
327.05	2.32E-03	96.97%
387.10	2.47E-03	96.26%
447.15	2.74E-03	95.50%
507.20	1.82E-03	94.83%
567.25	1.72E-03	94.30%
627.30	2.89E-03	93.63%
697.33	2.53E-03	92.70%
767.38	2.33E-03	91.86%
857.43	2.06E-03	90.89%
947.48	1.43E-03	90.12%
1057.55	1.09E-03	89.45%
1172.60	8.49E-04	88.90%
1352.65	8.02E-04	88.17%
1532.70	5.31E-04	87.58%
1722.75	3.71E-04	87.16%
1922.80	3.94E-04	86.79%
2142.85	3.20E-04	86.40%
2382.90	2.94E-04	86.04%
2669.60	2.17E-04	85.68%
2956.32	2.01E-04	85.39%
3243.03	1.54E-04	85.14%
3613.08	6.25E-05	84.94%
3983.13	7.42E-05	84.82%
4519.85	5.77E-05	84.64%
5056.57	1.62E-05	84.55%

Data Evaluation Grade: Test Grade (requires further evaluation)

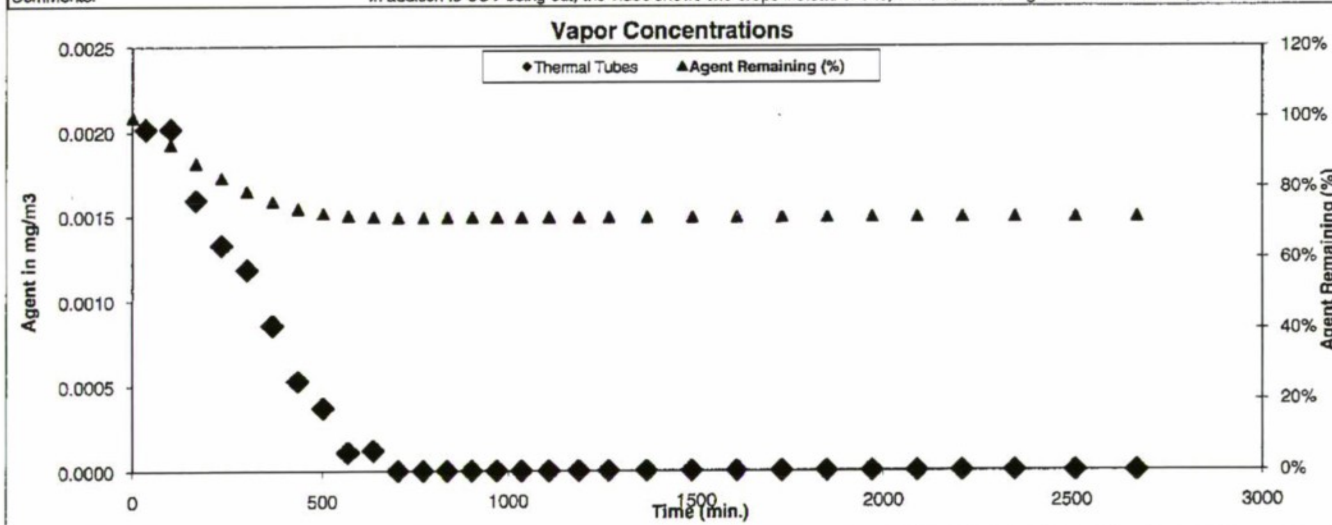
Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	01/18/07	50
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	35.71 °C	
Average air flow rate:	405.87 SLPM	
Average air temperature above drop:	34.97 °C	
Mass % recovery in vapor:	12.3 %	
Mass % recovery by extraction:	19.2 %	
Total agent % mass recovery:	31.5 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.75 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	1 of 4 ongoing ccvs outside +/- 30% (149%) - cvg	



Time (min)	Conc. mg/m^3	Agent rem. (%)
27.20	7.40E-04	99.95%
87.25	1.30E-03	99.65%
147.30	1.47E-03	99.24%
207.35	2.07E-03	98.72%
267.40	1.77E-03	98.15%
327.45	1.32E-03	97.70%
387.50	2.00E-03	97.21%
447.55	2.01E-03	96.62%
507.60	2.19E-03	96.00%
567.65	1.99E-03	95.39%
627.70	2.07E-03	94.79%
697.75	1.69E-03	94.14%
767.80	1.56E-03	93.58%
857.85	1.29E-03	92.95%
947.90	1.31E-03	92.38%
1057.95	9.27E-04	91.78%
1173.00	6.83E-04	91.32%
1353.05	6.41E-04	90.74%
1533.10	4.85E-04	90.24%
1723.15	3.79E-04	89.84%
1923.20	3.04E-04	89.50%
2143.25	2.62E-04	89.20%
2383.30	1.79E-04	88.94%
2670.02	1.66E-04	88.69%
2956.73	1.50E-04	88.47%
3243.45	9.26E-05	88.30%
3613.50	9.77E-05	88.13%
3983.55	9.38E-05	87.95%
4520.25	4.12E-05	87.78%
5056.97	2.42E-05	87.69%

Data Evaluation Grade: Not For Modeling

Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	03/01/07	59
Type of substrate :	UK Sand	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	36.45 °C	
Average air flow rate:	406.20 SLPM	
Average air temperature above drop:	35.88 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	6.3 %	
Mass % recovery in vapor:	28.4 %	
Total agent % mass recovery:	34.7 %	Raw evaporation rate: 0.61 µg/min
Tube #s consistant:	Yes	
Comments:	In addition to CCV being out, the video shows two drops instead of one, and a sandcastling event near the end ,i.e.NFM	

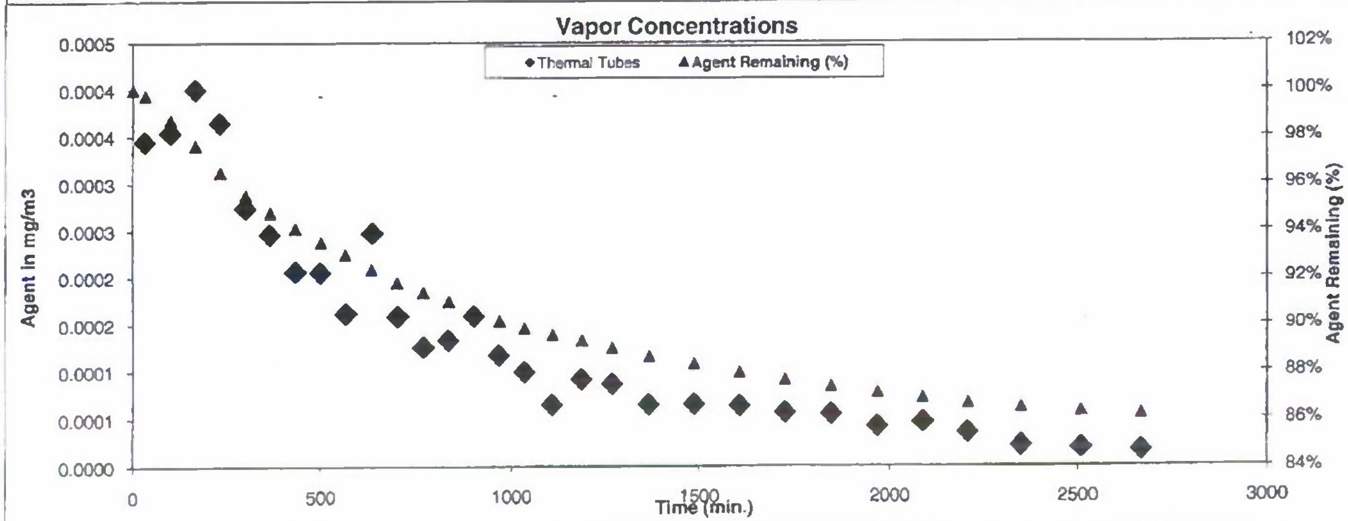


Time (min)	Conc. mg/m^3	Agent rem. (%)
33.92	2.02E-03	98.49%
100.67	2.02E-03	92.54%
167.43	1.60E-03	87.20%
234.20	1.33E-03	82.89%
300.97	1.19E-03	79.17%
367.72	8.57E-04	76.16%
434.49	5.29E-04	74.12%
501.25	3.71E-04	72.79%
568.00	1.10E-04	72.08%
634.77	1.20E-04	71.74%
701.54	0.00E+00	71.56%
768.30	0.00E+00	71.56%
835.05	0.00E+00	71.56%
901.82	0.00E+00	71.56%
968.58	0.00E+00	71.56%
1035.35	0.00E+00	71.56%
1108.78	0.00E+00	71.56%
1188.87	0.00E+00	71.56%
1268.97	0.00E+00	71.56%
1369.07	0.00E+00	71.56%
1489.17	0.00E+00	71.56%
1609.25	0.00E+00	71.56%
1729.35	0.00E+00	71.56%
1849.45	0.00E+00	71.56%
1969.53	0.00E+00	71.56%
2089.63	0.00E+00	71.56%
2209.73	0.00E+00	71.56%
2349.83	0.00E+00	71.56%
2509.92	0.00E+00	71.56%
2670.02	0.00E+00	71.56%

4 Copy of 20070222_3l_057(--+_a_3)VXtc_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	02/22/07	57
Type of substrate :	UK Sand	
Test agent/purity:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	35.16 °C	
Average air flow rate:	406.19 SLPM	
Average air temperature above drop:	35.38 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	8.6 %	
Total agent % mass recovery:	22.4 %	
Mass % recovery in vapor:	13.8 %	Raw evaporation rate: 0.14 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

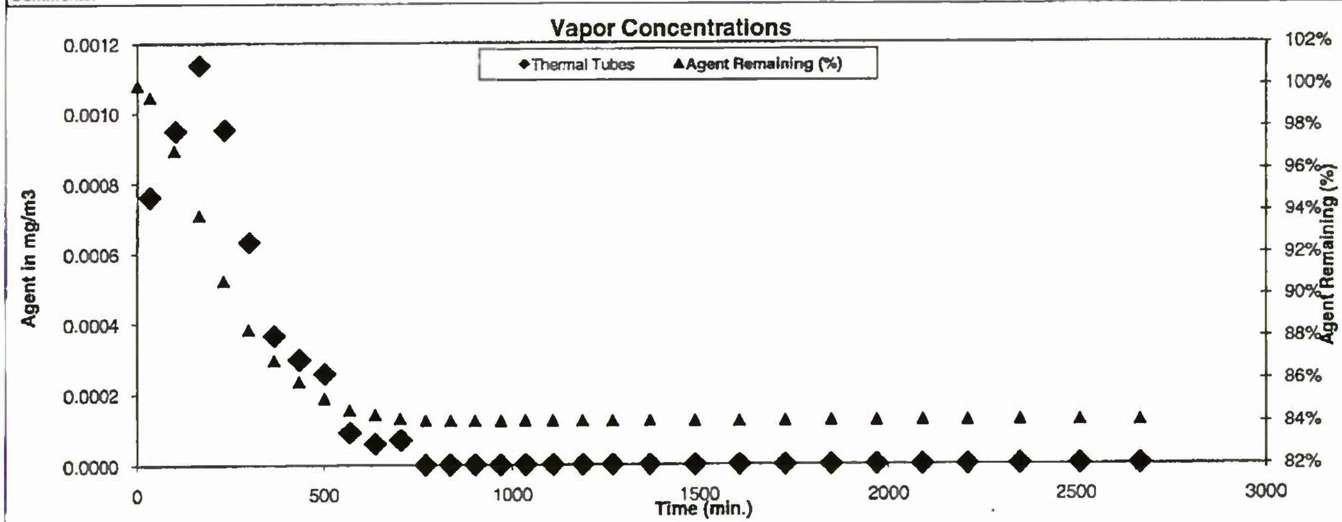


Time (min)	Conc. mg/m³	Agent rem. (%)
33.78	3.44E-04	99.74%
100.52	3.54E-04	98.71%
167.25	4.00E-04	97.60%
233.97	3.65E-04	96.47%
300.70	2.74E-04	95.53%
367.43	2.46E-04	94.77%
434.15	2.06E-04	94.10%
500.88	2.05E-04	93.49%
567.62	1.61E-04	92.95%
634.35	2.47E-04	92.35%
701.07	1.58E-04	91.75%
767.80	1.25E-04	91.33%
834.53	1.33E-04	90.95%
901.25	1.58E-04	90.52%
967.98	1.16E-04	90.12%
1034.72	9.84E-05	89.80%
1108.12	6.42E-05	89.54%
1188.18	9.10E-05	89.26%
1268.25	8.58E-05	88.95%
1368.30	6.45E-05	88.62%
1488.37	6.43E-05	88.28%
1608.43	6.27E-05	87.94%
1728.48	5.60E-05	87.63%
1848.55	5.47E-05	87.33%
1968.62	4.14E-05	87.08%
2088.68	4.58E-05	86.85%
2208.73	3.51E-05	86.63%
2348.80	2.12E-05	86.46%
2508.87	1.86E-05	86.32%
2668.93	1.62E-05	86.19%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	03/01/07	60
Type of substrate :	UK Sand	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	35.99 °C	
Average air flow rate:	406.41 SLPM	
Average air temperature above drop:	35.75 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	9.2 %	
Mass % recovery in vapor:	15.9 %	
Total agent % mass recovery:	25.1 %	Raw evaporation rate: 0.39 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

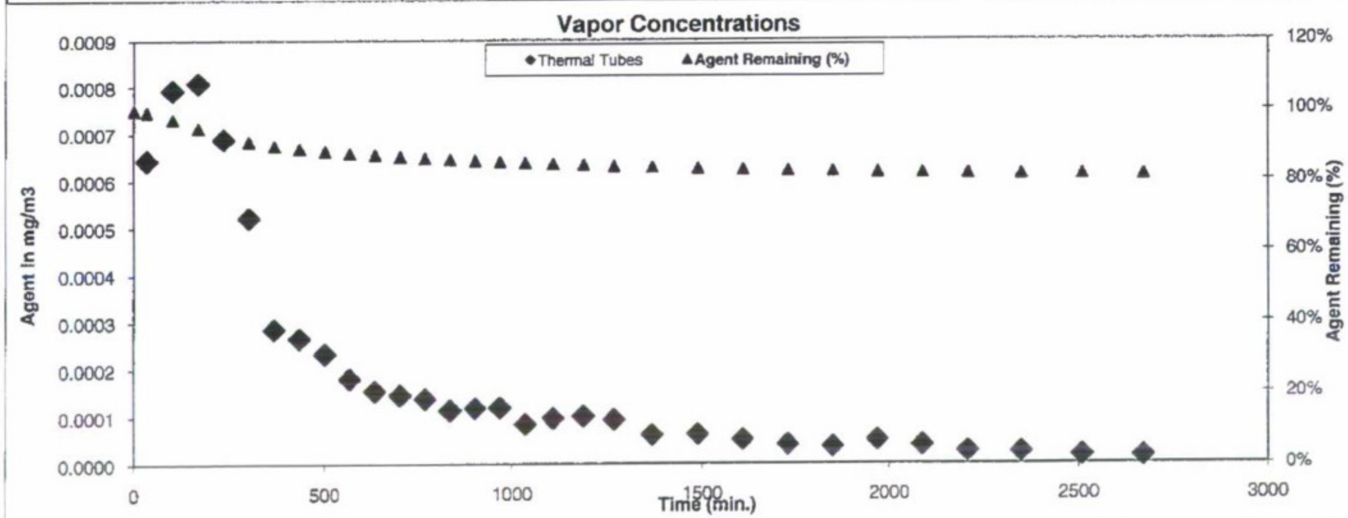
Time (min)	Conc. mg/m³	Agent rem. (%)
33.80	7.63E-04	99.43%
100.57	9.51E-04	96.90%
167.32	1.14E-03	93.82%
234.08	9.53E-04	90.73%
300.85	6.33E-04	88.39%
367.62	3.66E-04	86.92%
434.37	2.97E-04	85.94%
501.14	2.58E-04	85.12%
567.90	9.16E-05	84.60%
634.65	5.93E-05	84.38%
701.42	6.98E-05	84.19%
768.19	0.00E+00	84.09%
834.95	0.00E+00	84.09%
901.70	0.00E+00	84.09%
968.47	0.00E+00	84.09%
1035.23	0.00E+00	84.09%
1106.67	0.00E+00	84.09%
1188.77	0.00E+00	84.09%
1268.85	0.00E+00	84.09%
1368.95	0.00E+00	84.09%
1489.05	0.00E+00	84.09%
1609.15	0.00E+00	84.09%
1729.23	0.00E+00	84.09%
1849.33	0.00E+00	84.09%
1969.43	0.00E+00	84.09%
2089.52	0.00E+00	84.09%
2209.62	0.00E+00	84.09%
2349.72	0.00E+00	84.09%
2509.82	0.00E+00	84.09%
2669.90	0.00E+00	84.09%



3 Copy of 20070222_3k_058(--+_a_1)VXtc_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	02/22/07	58
Type of substrate :	UK Sand	
Test agent/purity:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	33.43 °C	
Average air flow rate:	406.35 SLPM	
Average air temperature above drop:	34.68 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	6.0 %	
Total agent % mass recovery:	24.5 %	
Mass % recovery in vapor:	18.5 %	Raw evaporation rate: 0.29 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

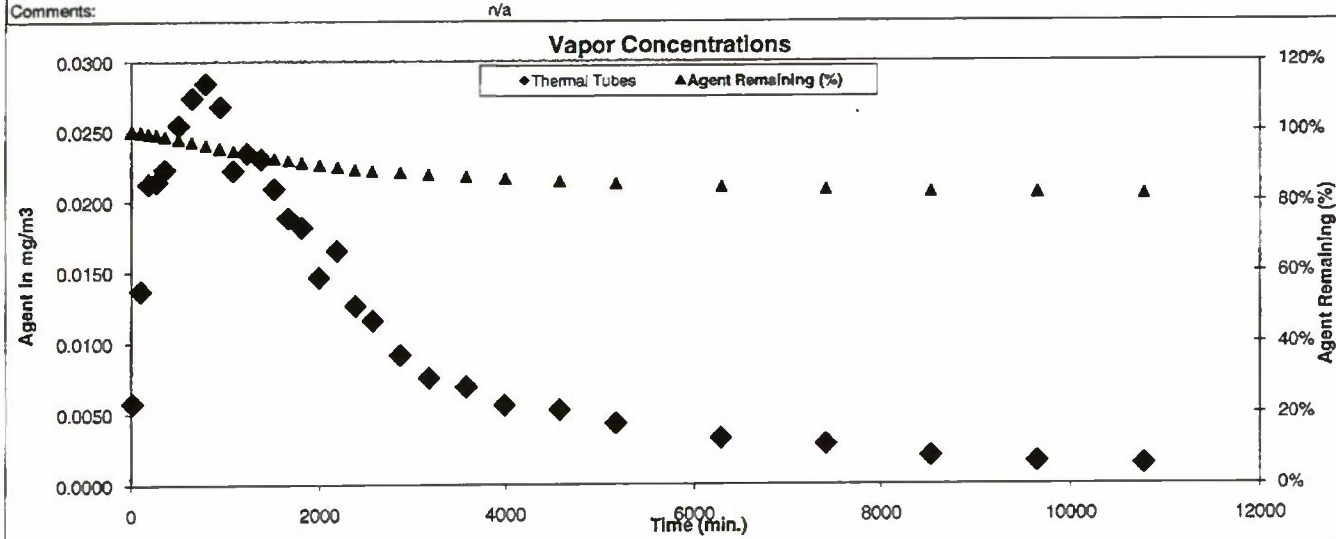


Time (min)	Conc. mg/m^3	Agent rem. (%)
33.92	6.43E-04	99.52%
100.63	7.93E-04	97.40%
167.37	8.08E-04	95.04%
234.10	6.88E-04	92.83%
300.82	5.21E-04	91.05%
367.55	2.85E-04	89.86%
434.28	2.65E-04	89.05%
501.02	2.33E-04	88.31%
567.74	1.80E-04	87.70%
634.47	1.54E-04	87.21%
701.20	1.46E-04	86.77%
767.92	1.37E-04	86.35%
834.65	1.14E-04	85.98%
901.38	1.18E-04	85.64%
968.12	1.19E-04	85.29%
1034.85	8.37E-05	84.99%
1108.23	9.68E-05	84.70%
1188.30	1.01E-04	84.35%
1268.37	9.30E-05	84.01%
1368.43	6.05E-05	83.67%
1488.48	6.19E-05	83.34%
1608.55	5.08E-05	83.04%
1728.62	4.03E-05	82.80%
1848.68	3.63E-05	82.60%
1968.73	5.01E-05	82.37%
2088.80	3.92E-05	82.13%
2208.87	2.65E-05	81.96%
2348.92	2.52E-05	81.80%
2508.98	1.73E-05	81.65%
2669.05	1.56E-05	81.53%

6 Copy of 20070301_3c_199(-+-_a_4)VXtc_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	03/01/07	199
Type of substrate :	Sand(UK)	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	34.64 °C	
Average air flow rate:	18.03 SLPM	
Average air temperature above drop:	35.11 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	22.5 %	
Mass % recovery in vapor:	18.0 %	
Total agent % mass recovery:	40.5 %	Raw evaporation rate: 0.43 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	



Time (min)	Conc. mg/m^3	Agent rem. (%)
13.70	5.78E-03	99.99%
98.75	1.37E-02	99.81%
183.80	2.13E-02	99.49%
268.83	2.14E-02	99.09%
353.88	2.23E-02	98.69%
498.93	2.54E-02	97.93%
643.98	2.74E-02	97.10%
789.02	2.84E-02	96.21%
934.07	2.68E-02	95.34%
1079.12	2.22E-02	94.57%
1224.15	2.35E-02	93.85%
1369.20	2.30E-02	93.11%
1514.25	2.09E-02	92.42%
1659.30	1.89E-02	91.79%
1804.33	1.82E-02	91.20%
1996.05	1.47E-02	90.52%
2187.77	1.65E-02	89.87%
2379.48	1.26E-02	89.26%
2571.20	1.16E-02	88.75%
2863.73	9.13E-03	88.09%
3173.78	7.51E-03	87.53%
3577.17	6.89E-03	86.89%
3990.53	5.59E-03	86.33%
4570.58	5.25E-03	85.65%
5170.63	4.29E-03	85.02%
6290.68	3.26E-03	84.10%
7410.72	2.84E-03	83.36%
8530.75	2.03E-03	82.76%
9650.80	1.62E-03	82.32%
10770.85	1.39E-03	81.95%

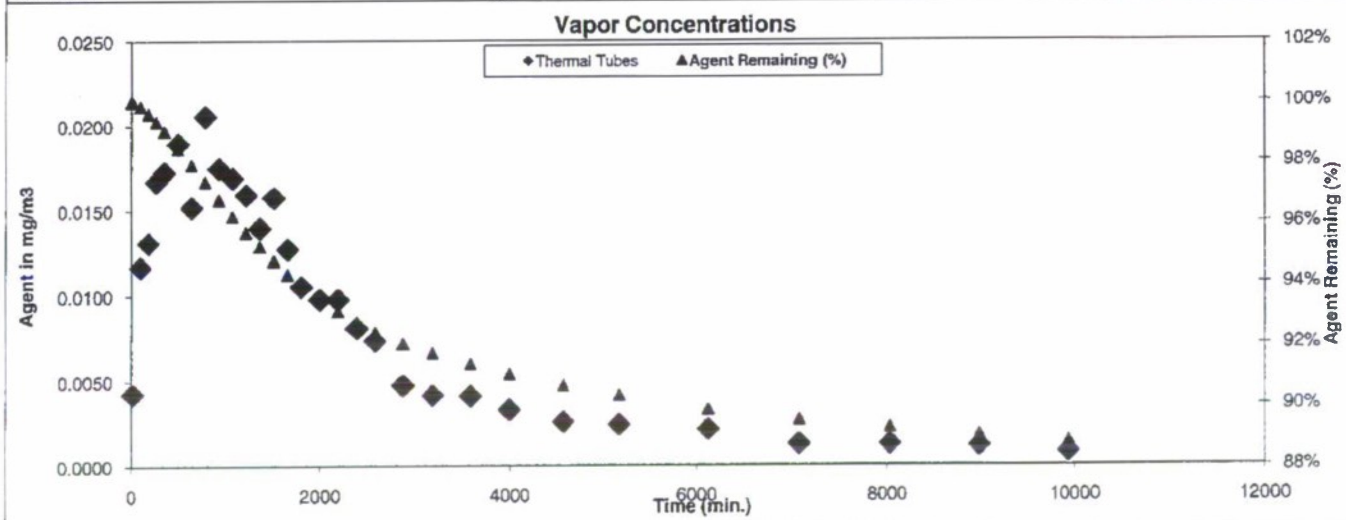
Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	02/20/07 198
Type of substrate :	Sand(UK)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	34.67 °C
Average air flow rate:	18.03 SLPM
Average air temperature above drop:	35.69 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	36.2 %
Total agent % mass recovery:	47.4 %
Mass % recovery in vapor:	11.2 %
Tube #s consistant:	Yes
Comments:	n/a

Agent Purity	
HD CASARM	97.4%
HD Munitions	78.2%
VX	91.0%

Data Evaluation		
SD	%SD	Status
0.2	0.46%	Go
0.1	0.70%	Go
0.1	0.36%	Go
-	-	Go

Raw evaporation rate: 0.30 µg/min



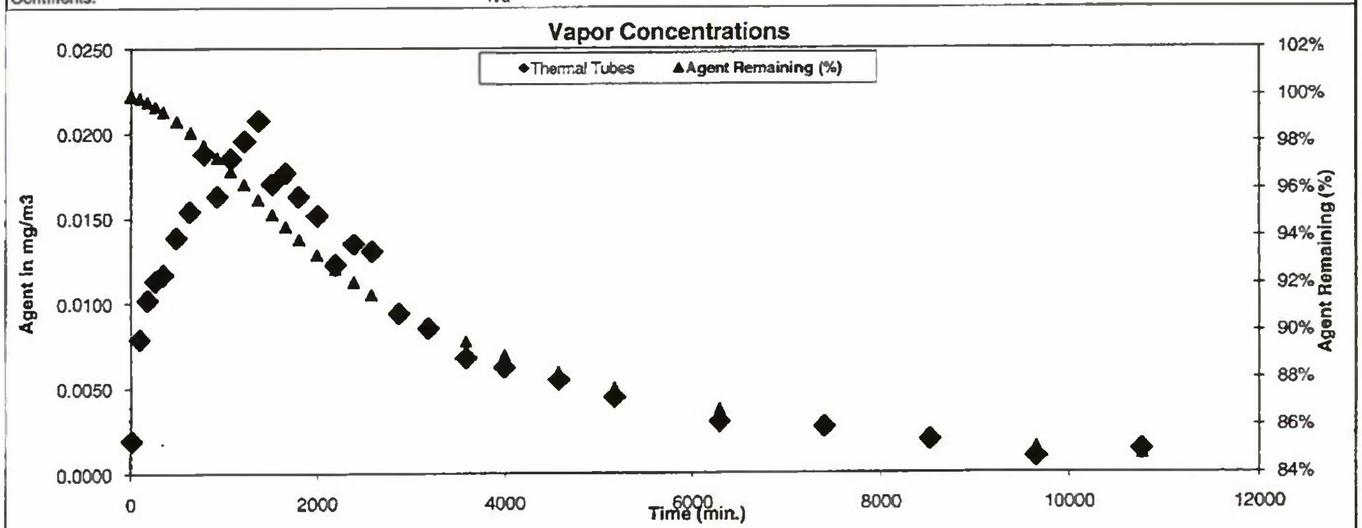
Time (min)	Conc. mg/m^3	Agent rem. (%)
13.87	4.25E-03	99.99%
98.92	1.17E-02	99.85%
183.97	1.31E-02	99.62%
269.02	1.67E-02	99.34%
354.05	1.73E-02	99.03%
499.10	1.89E-02	98.45%
644.15	1.52E-02	97.91%
789.18	2.06E-02	97.35%
934.23	1.75E-02	96.75%
1079.28	1.69E-02	96.20%
1224.33	1.59E-02	95.69%
1369.37	1.40E-02	95.21%
1514.42	1.58E-02	94.74%
1659.47	1.27E-02	94.29%
1804.52	1.05E-02	93.93%
1996.23	9.78E-03	93.50%
2187.93	9.76E-03	93.09%
2379.65	8.09E-03	92.72%
2571.37	7.34E-03	92.40%
2863.92	4.74E-03	92.01%
3173.95	4.14E-03	91.71%
3577.33	4.11E-03	91.35%
3990.72	3.29E-03	91.02%
4570.77	2.58E-03	90.65%
5170.80	2.41E-03	90.32%
6124.18	2.12E-03	89.85%
7077.57	1.23E-03	89.50%
8030.95	1.24E-03	89.25%
8984.32	1.15E-03	89.00%
9937.70	7.74E-04	88.80%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	03/01/07	162
Type of substrate :	Sand(UK)	
Test agent:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	9	µL
Mass of agent disseminated:	9.09	mg
Corrected mass on 100% agent purity:	8.27	mg
Average substrate temperature:	35.26	°C
Average air flow rate:	18.07	SLPM
Average air temperature above drop:	34.94	°C
CCVs within criteria:	Yes	
Mass % recovery by extraction:	25.5	%
Mass % recovery in vapor:	15.2	%
Total agent % mass recovery:	40.7	%
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.32 µg/min

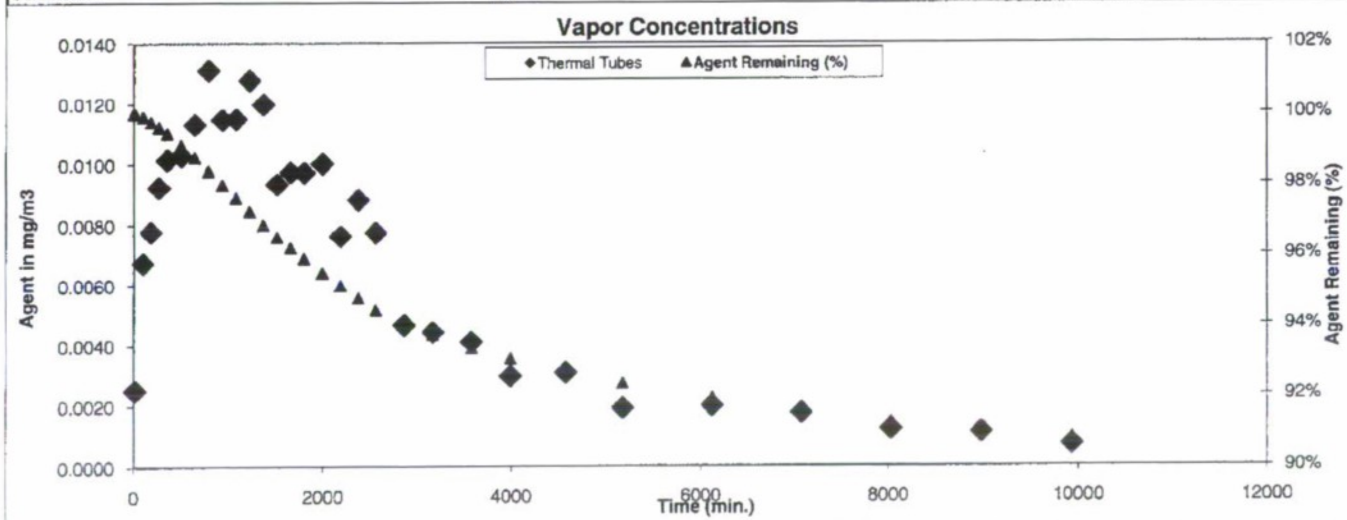
Time (min)	Conc. mg/m^3	Agent rem. (%)
13.83	1.93E-03	100.00%
98.88	7.91E-03	99.91%
183.93	1.02E-02	99.74%
268.98	1.13E-02	99.54%
354.03	1.17E-02	99.32%
499.08	1.39E-02	98.92%
644.12	1.54E-02	98.45%
789.17	1.88E-02	97.91%
934.22	1.63E-02	97.36%
1079.27	1.85E-02	96.81%
1224.32	1.95E-02	96.20%
1369.37	2.07E-02	95.57%
1514.42	1.70E-02	94.97%
1659.47	1.77E-02	94.42%
1804.50	1.62E-02	93.88%
1996.23	1.51E-02	93.22%
2187.95	1.23E-02	92.65%
2379.65	1.35E-02	92.11%
2571.37	1.30E-02	91.56%
2863.92	9.36E-03	90.84%
3173.97	8.51E-03	90.24%
3577.35	6.75E-03	89.56%
3990.73	6.19E-03	88.98%
4570.78	5.45E-03	88.24%
5170.83	4.42E-03	87.59%
6290.88	3.00E-03	86.69%
7410.92	2.66E-03	85.99%
8530.95	1.95E-03	85.43%
9651.00	9.29E-04	85.07%
10771.05	1.36E-03	84.79%



Data Evaluation Grade: **Modeling Grade**

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	02/20/07 161
Type of substrate :	Sand(UK)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	34.63 °C
Average air flow rate:	18.08 SLPM
Average air temperature above drop:	34.96 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	23.2 %
Total agent % mass recovery:	32.4 %
Mass % recovery in vapor:	9.2 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 0.19 µg/min

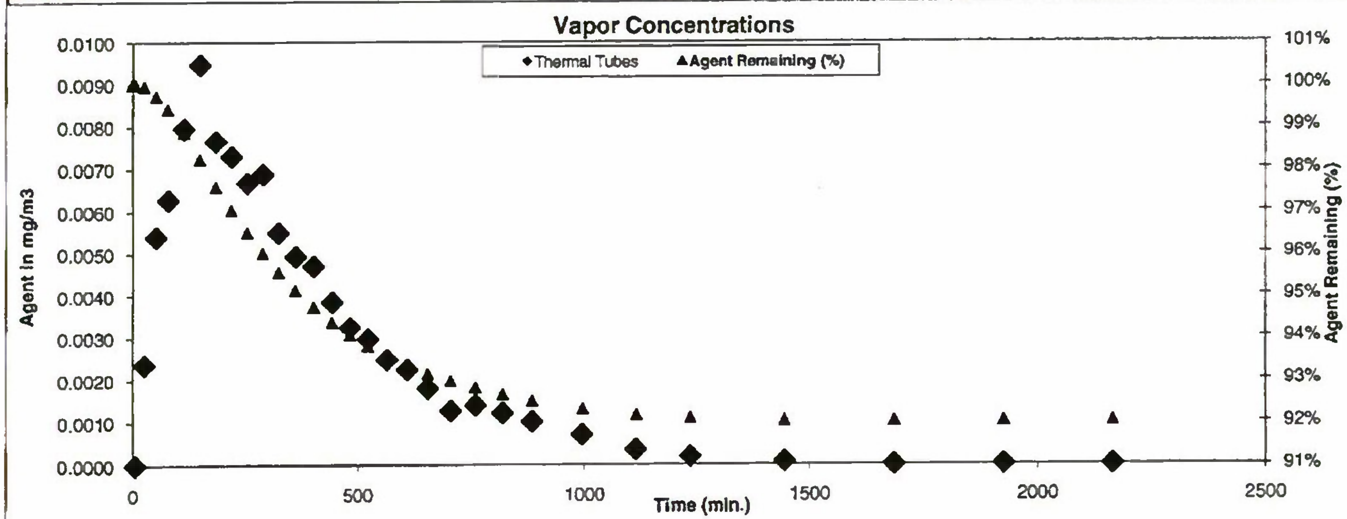


Time (min)	Conc. mg/m^3	Agent rem. (%)
14.13	2.51E-03	100.00%
99.18	6.74E-03	99.91%
184.23	7.78E-03	99.78%
269.28	9.24E-03	99.62%
354.33	1.02E-02	99.44%
499.38	1.03E-02	99.11%
644.43	1.13E-02	98.77%
789.47	1.31E-02	98.38%
934.52	1.15E-02	97.99%
1079.57	1.15E-02	97.63%
1224.62	1.28E-02	97.24%
1369.67	1.20E-02	96.85%
1514.72	9.35E-03	96.51%
1659.77	9.74E-03	96.21%
1804.82	9.73E-03	95.90%
1996.53	1.00E-02	95.49%
2188.25	7.63E-03	95.12%
2379.97	8.83E-03	94.78%
2571.68	7.75E-03	94.43%
2864.22	4.67E-03	94.03%
3174.27	4.43E-03	93.72%
3577.65	4.10E-03	93.35%
3991.03	2.96E-03	93.03%
4571.08	3.07E-03	92.65%
5171.13	1.90E-03	92.32%
6124.52	1.98E-03	91.92%
7077.90	1.74E-03	91.53%
8031.28	1.21E-03	91.22%
8984.65	1.11E-03	90.98%
9938.03	7.13E-04	90.79%

2 Copy of 20070227_3l_058(+--_a_3)VXtc_Suk.xls

Data Evaluation Grade: Test Grade

Tunnel:	3L		
Instruments:	VTS#10/GCMSD		
Date/Experiment #:	02/27/07	58	
Type of substrate :	UK Sand		
Test agent/purity:	VX_TCgrade		
Number of drops:	1		
Nominal drop volume:	1	µL	
Mass of agent disseminated:	1.01	mg	
Corrected mass on 100% agent purity:	0.92	mg	
Average substrate temperature:	49.79	°C	
Average air flow rate:	19.49	SLPM	
Average air temperature above drop:	49.68	°C	
CCVs within criteria:	No		
Mass % recovery by extraction:	9.8	%	
Total agent % mass recovery:	17.8	%	
Mass % recovery in vapor:	8.0	%	Raw evaporation rate: 0.14 µg/min
Tube #s consistant:	Yes		
Comments:	Two out of the four continuing calibration verifications (CCV's) are outside of limits		

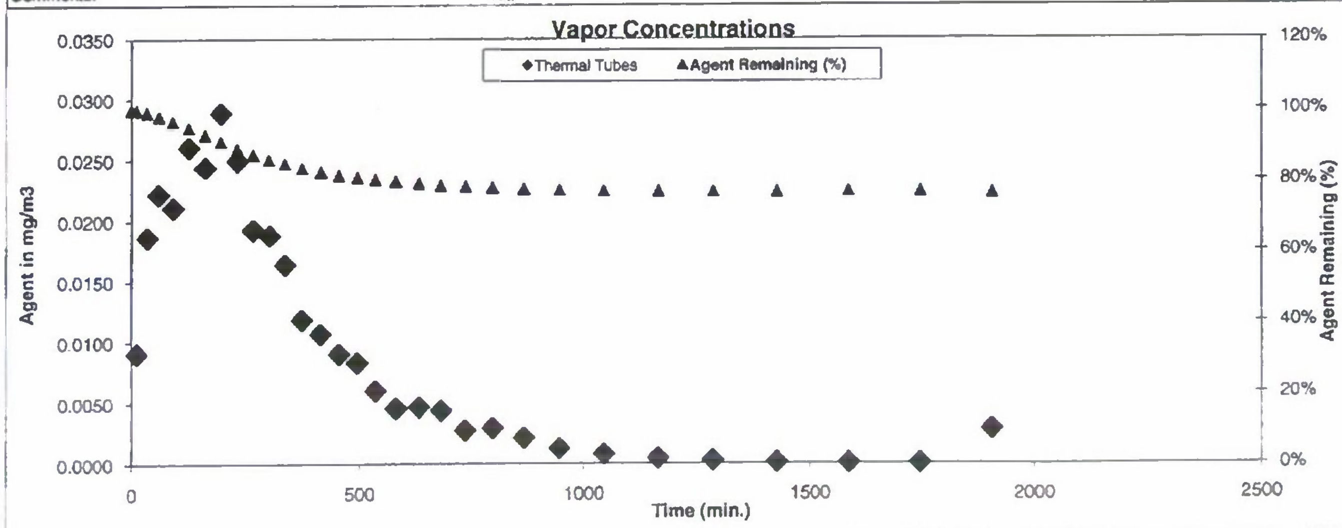


Time (min)	Conc. mg/m³	Agent rem. (%)
5.55	0.00E+00	100.00%
25.60	2.36E-03	99.95%
52.30	5.41E-03	99.73%
79.02	6.27E-03	99.40%
114.07	7.95E-03	98.87%
149.12	9.46E-03	98.22%
184.15	7.65E-03	97.59%
219.20	7.29E-03	97.03%
254.25	6.67E-03	96.51%
289.30	6.88E-03	96.01%
324.33	5.50E-03	95.55%
361.88	4.94E-03	95.13%
401.93	4.71E-03	94.73%
441.97	3.85E-03	94.36%
482.02	3.23E-03	94.06%
522.07	2.96E-03	93.80%
564.62	2.46E-03	93.55%
609.67	2.25E-03	93.33%
654.72	1.80E-03	93.14%
704.75	1.26E-03	92.97%
759.80	1.40E-03	92.82%
819.85	1.22E-03	92.65%
884.88	1.01E-03	92.50%
994.93	6.93E-04	92.30%
1114.98	3.56E-04	92.17%
1235.03	1.85E-04	92.10%
1445.07	6.82E-05	92.04%
1685.12	0.00E+00	92.02%
1925.17	0.00E+00	92.02%
2165.20	0.00E+00	92.02%

Data Evaluation Grade: Modeling Grade

Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	03/07/07	61
Type of substrate :	UK Sand	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1	µL
Mass of agent disseminated:	1.01	mg
Corrected mass on 100% agent purity:	0.92	mg
Average substrate temperature:	49.64	°C
Average air flow rate:	19.61	SLPM
Average air temperature above drop:	49.19	°C
CCVs within criteria:	Yes	
Mass % recovery by extraction:	11.9	%
Mass % recovery in vapor:	23.6	%
Total agent % mass recovery:	35.5	%
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.48 µg/min

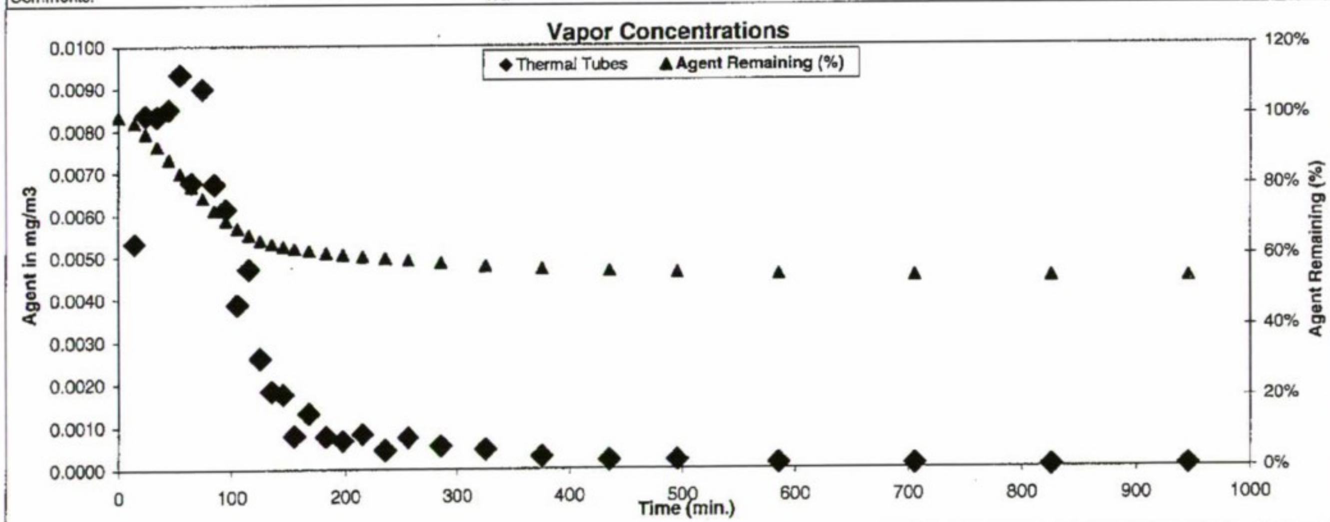


Time (min)	Conc. mg/m^3	Agent rem. (%)
11.33	9.06E-03	99.89%
34.73	1.87E-02	99.20%
61.45	2.22E-02	98.03%
92.35	2.11E-02	96.61%
127.42	2.61E-02	94.84%
162.48	2.44E-02	92.96%
197.53	2.89E-02	90.96%
232.60	2.50E-02	88.95%
267.67	1.93E-02	87.30%
302.72	1.88E-02	85.87%
337.78	1.63E-02	84.56%
375.35	1.18E-02	83.43%
415.42	1.06E-02	82.48%
455.47	9.01E-03	81.64%
495.53	8.30E-03	80.90%
535.60	6.00E-03	80.29%
580.67	4.54E-03	79.78%
630.73	4.67E-03	79.29%
680.78	4.40E-03	78.81%
735.85	2.72E-03	78.39%
795.92	2.87E-03	78.03%
865.98	2.07E-03	77.66%
946.03	1.24E-03	77.38%
1046.10	7.72E-04	77.16%
1166.17	4.25E-04	77.01%
1286.22	2.49E-04	76.92%
1426.28	8.43E-05	76.87%
1586.33	3.57E-05	76.85%
1746.40	0.00E+00	76.85%
1906.45	2.77E-03	76.37%

13 Copy of 20070116_3L_047(+-+_a_1)VXtc_Suk.xls

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	01/16/07	47
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	50.66 °C	
Average air flow rate:	405.42 SLPM	
Average air temperature above drop:	50.54 °C	
Mass % recovery in vapor:	46.3 %	
Mass % recovery by extraction:	4.9 %	
Total agent % mass recovery:	51.2 %	
Tube #s consistant:	Yes	Raw evaporation rate: 3.3 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	



Time (min)	Conc. mg/m^3	Agent rem. (%)
14.42	5.33E-03	98.30%
24.47	8.36E-03	95.27%
34.52	8.33E-03	91.57%
44.57	8.51E-03	87.84%
54.62	9.33E-03	83.89%
64.67	6.78E-03	80.32%
74.72	8.98E-03	76.82%
84.77	6.73E-03	73.34%
94.82	6.14E-03	70.49%
104.87	3.88E-03	68.27%
114.92	4.72E-03	66.36%
124.97	2.61E-03	64.74%
135.02	1.84E-03	63.75%
145.05	1.76E-03	62.96%
155.10	7.89E-04	62.39%
167.67	1.31E-03	61.81%
182.72	7.60E-04	61.12%
197.77	6.66E-04	60.65%
215.32	8.20E-04	60.07%
235.37	4.42E-04	59.51%
255.42	7.37E-04	58.99%
285.47	5.34E-04	58.15%
325.52	4.50E-04	57.28%
375.57	2.89E-04	56.47%
435.62	2.00E-04	55.82%
495.67	1.94E-04	55.30%
585.72	1.15E-04	54.68%
705.77	8.42E-05	54.16%
825.82	2.93E-05	53.86%
945.87	4.63E-05	53.66%

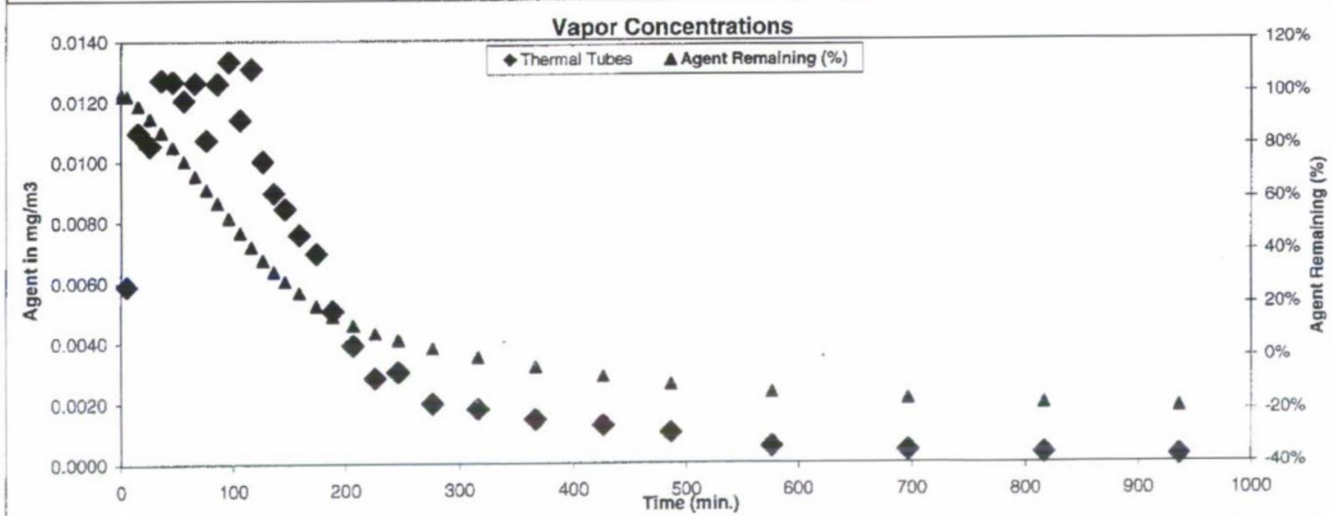
14 Copy of 20070129_3L_051(+-+_a_2)VXtc_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L
Instruments:	VTS#10/GCMSD
Date/Experiment #:	01/29/07 51
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	50.33 °C
Average air flow rate:	405.51 SLPM
Average air temperature above drop:	50.53 °C
Mass % recovery in vapor:	119.0 %
Mass % recovery by extraction:	5.0 %
Total agent % mass recovery:	124.0 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	Ongoing CCVs were spiked incorrectly. Data bracketed by acceptable ccvs

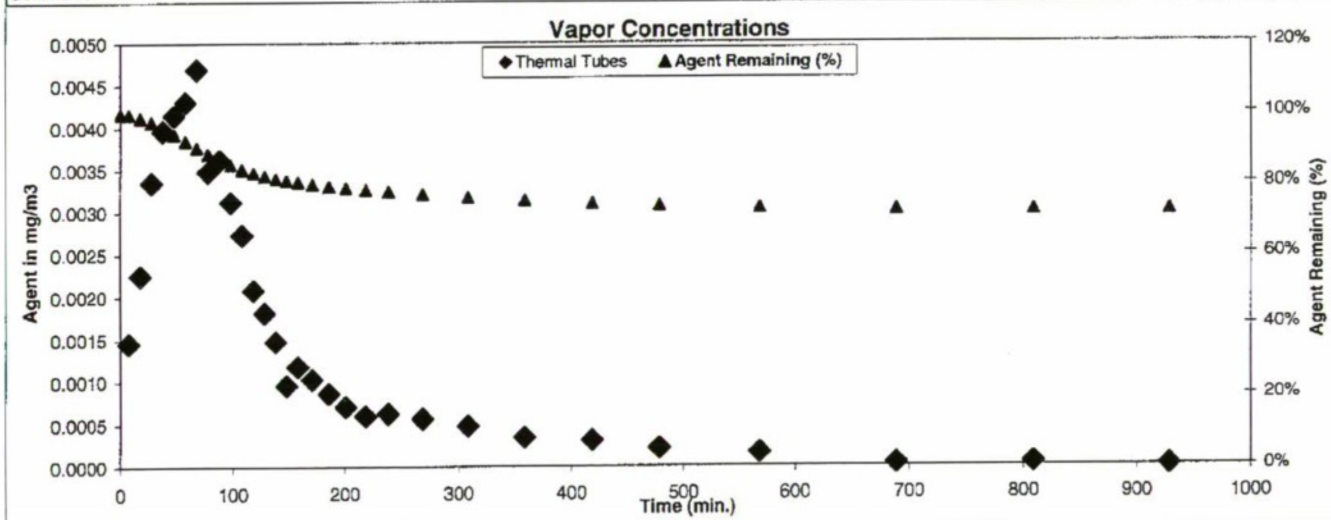
Raw evaporation rate: 4.9 µg/min

Time (min)	Conc. mg/m^3	Agent rem. (%)
5.07	5.88E-03	99.34%
15.12	1.10E-02	95.61%
25.17	1.05E-02	90.84%
35.22	1.27E-02	85.68%
45.27	1.27E-02	80.05%
55.32	1.20E-02	74.57%
65.37	1.26E-02	69.10%
75.42	1.07E-02	63.93%
85.47	1.26E-02	58.75%
95.52	1.33E-02	53.00%
105.57	1.14E-02	47.52%
115.62	1.31E-02	42.09%
125.67	1.00E-02	36.97%
135.72	8.96E-03	32.76%
145.77	8.44E-03	28.90%
158.32	7.57E-03	24.47%
173.37	8.94E-03	19.66%
188.42	5.04E-03	15.68%
205.97	3.91E-03	12.21%
226.02	2.83E-03	9.23%
246.07	3.03E-03	6.64%
276.12	1.98E-03	3.32%
316.17	1.80E-03	-0.01%
366.22	1.45E-03	-3.60%
426.27	1.25E-03	-7.18%
486.32	1.01E-03	-10.17%
576.37	5.34E-04	-13.24%
696.42	4.03E-04	-15.72%
816.47	3.10E-04	-17.61%
936.52	2.20E-04	-19.02%



Data Evaluation Grade: **Modeling Grade**

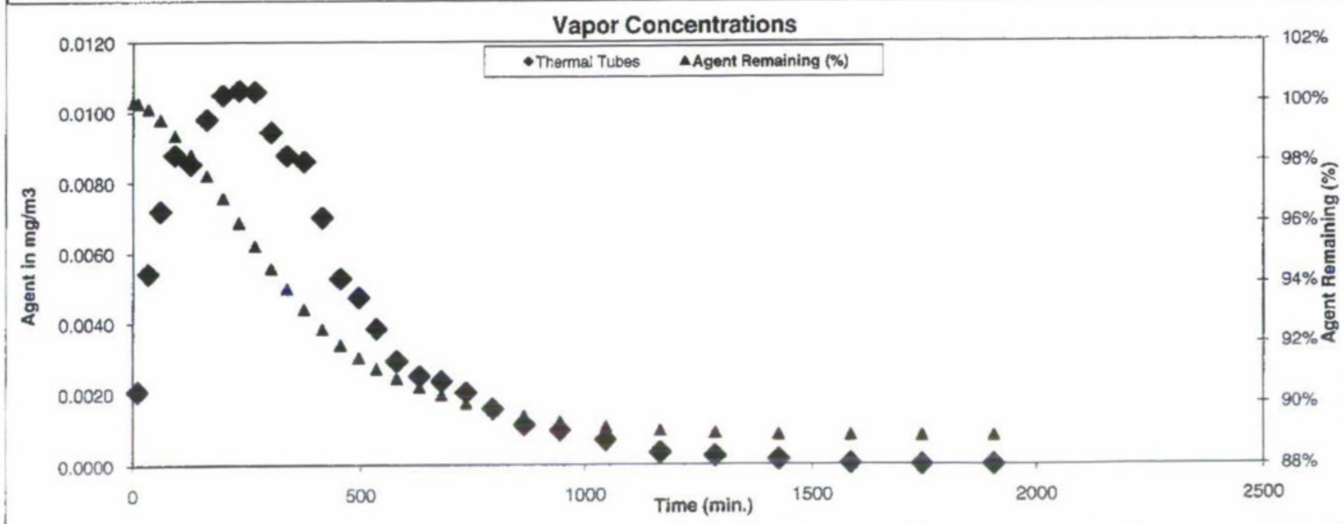
Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	01/16/07	49
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	48.75 °C	
Average air flow rate:	405.70 SLPM	
Average air temperature above drop:	49.93 °C	
Mass % recovery in vapor:	27.8 %	
Mass % recovery by extraction:	10.7 %	
Total agent % mass recovery:	38.5 %	
Tube #s consistant:	Yes	Raw evaporation rate: 1.6 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	



Time (min)	Conc. mg/m³	Agent rem. (%)
7.37	1.45E-03	99.76%
17.42	2.25E-03	98.94%
27.45	3.35E-03	97.70%
37.50	3.96E-03	96.08%
47.55	4.15E-03	94.28%
57.60	4.31E-03	92.40%
67.65	4.69E-03	90.41%
77.70	3.48E-03	88.60%
87.75	3.62E-03	87.02%
97.80	3.12E-03	85.53%
107.85	2.73E-03	84.23%
117.90	2.08E-03	83.16%
127.95	1.81E-03	82.30%
138.00	1.47E-03	81.57%
148.05	9.54E-04	81.03%
158.10	1.17E-03	80.56%
170.65	1.03E-03	79.95%
185.70	8.56E-04	79.33%
200.75	7.02E-04	78.81%
218.30	5.94E-04	78.31%
238.35	6.18E-04	77.77%
268.40	5.60E-04	76.99%
308.45	4.73E-04	76.08%
358.50	3.36E-04	75.18%
418.55	3.04E-04	74.33%
478.60	2.10E-04	73.65%
568.63	1.54E-04	72.93%
688.68	3.04E-05	72.44%
808.73	3.38E-05	72.27%
928.78	3.14E-07	72.18%

Data Evaluation Grade: Test Grade - requires further evaluation - see comments

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	03/07/07	62
Type of substrate :	UK Sand	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	48.53 °C	
Average air flow rate:	19.51 SLPM	
Average air temperature above drop:	48.91 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	11.5 %	
Mass % recovery in vapor:	11.1 %	
Total agent % mass recovery:	22.6 %	Raw evaporation rate: 0.18 µg/min
Tube #s consistant:	Yes	
Comments:	This run is "off matrix" to the extent of -1.1° in airtemp, -1.5° in substrate Temp and windspeed is high.	

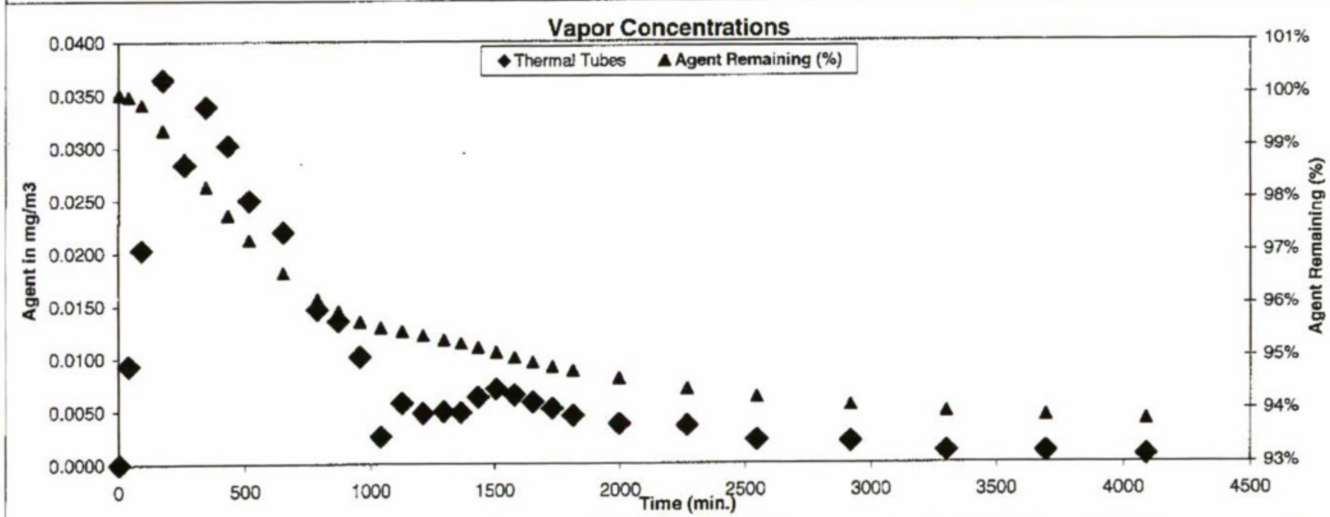


Time (min)	Conc. mg/m^3	Agent rem. (%)
10.55	2.07E-03	99.98%
33.95	5.42E-03	99.79%
60.67	7.20E-03	99.43%
91.57	8.79E-03	98.91%
126.63	8.53E-03	98.26%
161.70	9.81E-03	97.58%
196.75	1.05E-02	96.83%
231.82	1.06E-02	96.04%
266.88	1.06E-02	95.25%
301.93	9.45E-03	94.50%
337.00	8.78E-03	93.83%
374.57	8.61E-03	93.13%
414.63	7.03E-03	92.47%
454.68	5.28E-03	91.94%
494.75	4.73E-03	91.52%
534.82	3.84E-03	91.15%
579.88	2.92E-03	90.83%
629.95	2.50E-03	90.54%
680.00	2.35E-03	90.28%
735.07	2.03E-03	90.03%
795.13	1.57E-03	89.80%
865.20	1.12E-03	89.60%
945.25	9.67E-04	89.42%
1045.32	6.94E-04	89.24%
1165.38	3.37E-04	89.11%
1285.43	2.44E-04	89.04%
1425.49	1.46E-04	88.98%
1585.55	3.17E-05	88.95%
1745.62	0.00E+00	88.95%
1905.67	0.00E+00	88.95%

Data Evaluation Grade: **Not for modeling**

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	01/17/07 189
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	48.76 °C
Average air flow rate:	16.48 SLPM
Average air temperature above drop:	49.38 °C
Mass % recovery in vapor:	6.2 %
Mass % recovery by extraction:	7.1 %
Total agent % mass recovery:	13.3 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	Flow is very unsteady

Raw evaporation rate: 0.47 µg/min

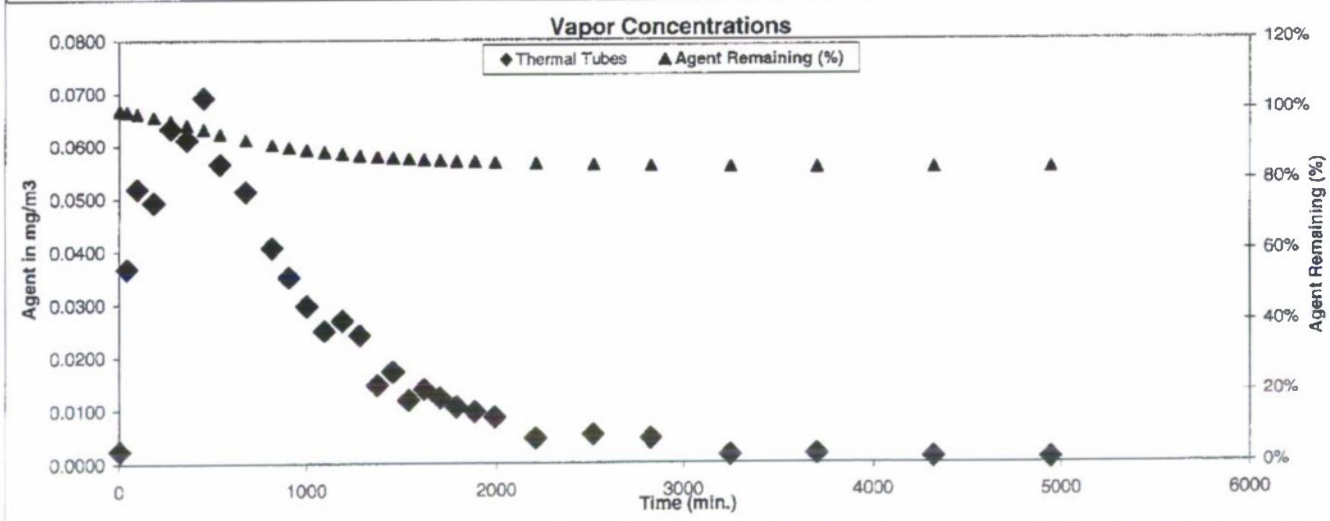


Time (min)	Conc. mg/m³	Agent rem. (%)
3.72	0.00E+00	100.00%
38.77	9.31E-03	99.97%
90.47	2.03E-02	99.81%
175.52	3.64E-02	99.33%
260.57	2.84E-02	98.79%
345.60	3.39E-02	98.26%
430.65	3.02E-02	97.72%
515.70	2.49E-02	97.25%
650.75	2.20E-02	96.62%
785.79	1.46E-02	96.13%
870.84	1.35E-02	95.89%
955.89	1.01E-02	95.69%
1040.94	2.57E-03	95.58%
1125.97	5.75E-03	95.51%
1211.02	4.78E-03	95.42%
1296.07	4.93E-03	95.34%
1364.45	4.83E-03	95.27%
1433.67	6.28E-03	95.20%
1505.37	7.03E-03	95.10%
1578.75	6.47E-03	95.00%
1652.14	5.78E-03	94.91%
1729.67	5.18E-03	94.83%
1811.38	4.51E-03	94.75%
1995.60	3.68E-03	94.60%
2265.65	3.55E-03	94.40%
2545.68	2.17E-03	94.24%
2919.07	2.02E-03	94.09%
3302.45	1.09E-03	93.97%
3695.83	1.04E-03	93.89%
4089.20	7.04E-04	93.82%

13 Copy of 20070125_3L_050(++-_a_1)VXtc_Suk.xls

Data Evaluation Grade: Test Grade (requires further evaluation)

Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	01/25/07	50
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	49.95 °C	
Average air flow rate:	18.72 SLPM	
Average air temperature above drop:	49.93 °C	
Mass % recovery in vapor:	16.8 %	
Mass % recovery by extraction:	8.8 %	
Total agent % mass recovery:	25.7 %	
Tube #s consistant:	Yes	Raw evaporation rate: 1.1 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	1 of 4 CCVs were mis-spiked - cvg	



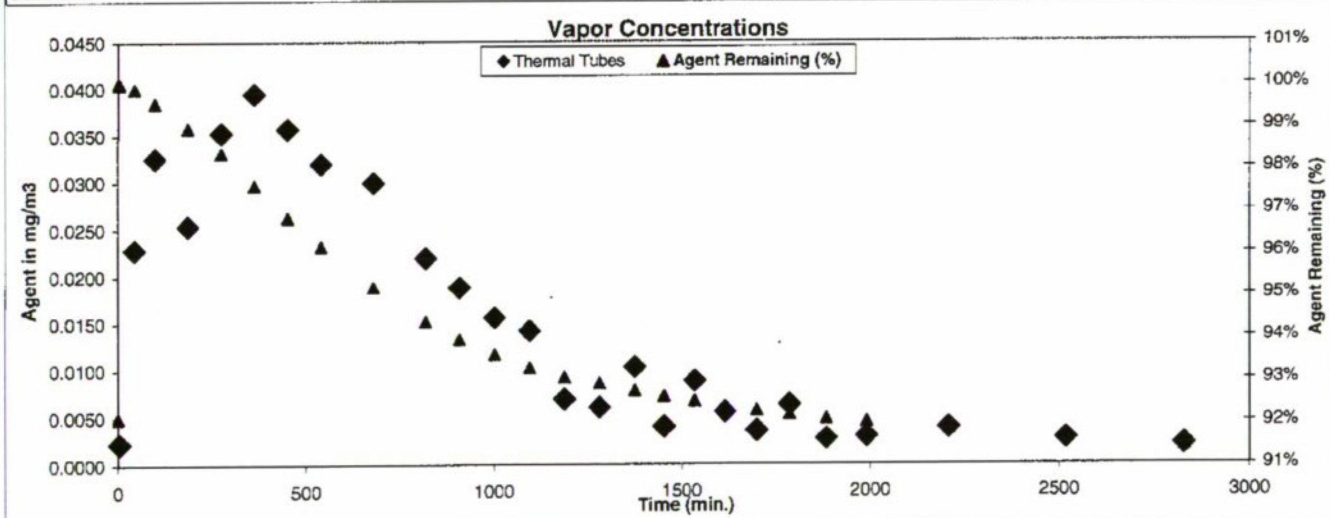
Time (min)	Conc. mg/m^3	Agent rem. (%)
4.22	2.36E-03	100.00%
42.58	3.68E-02	99.83%
97.63	5.19E-02	99.28%
186.02	4.93E-02	98.27%
274.40	6.33E-02	97.14%
362.78	6.11E-02	95.90%
451.17	6.91E-02	94.59%
539.55	5.65E-02	93.34%
677.93	5.13E-02	91.65%
816.32	4.07E-02	90.21%
907.20	3.51E-02	89.43%
1000.58	2.97E-02	88.74%
1093.97	2.49E-02	88.16%
1187.35	2.69E-02	87.62%
1280.73	2.41E-02	87.08%
1374.12	1.47E-02	86.67%
1453.33	1.72E-02	86.38%
1535.05	1.18E-02	86.11%
1616.77	1.39E-02	85.88%
1700.98	1.23E-02	85.63%
1787.70	1.06E-02	85.40%
1884.42	9.66E-03	85.18%
1991.13	8.66E-03	84.96%
2207.85	4.59E-03	84.63%
2517.90	5.33E-03	84.28%
2827.95	4.57E-03	83.94%
3251.33	1.47E-03	83.65%
3704.72	1.64E-03	83.49%
4324.77	1.03E-03	83.30%
4944.82	8.13E-04	83.17%

7 Copy of 20070125_3k_052(++-_a_1)VXtc_Suk-NFM.xls

Data Evaluation Grade: Not for modeling

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	01/25/07	52
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	9	µL
Mass of agent disseminated:	9.09	mg
Corrected mass on 100% agent purity:	8.27	mg
Average substrate temperature:	49.52	°C
Average air flow rate:	18.87	SLPM
Average air temperature above drop:	49.27	°C
Mass % recovery in vapor:	7.9	%
Mass % recovery by extraction:	2.9	%
Total agent % mass recovery:	10.8	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.63 µg/min

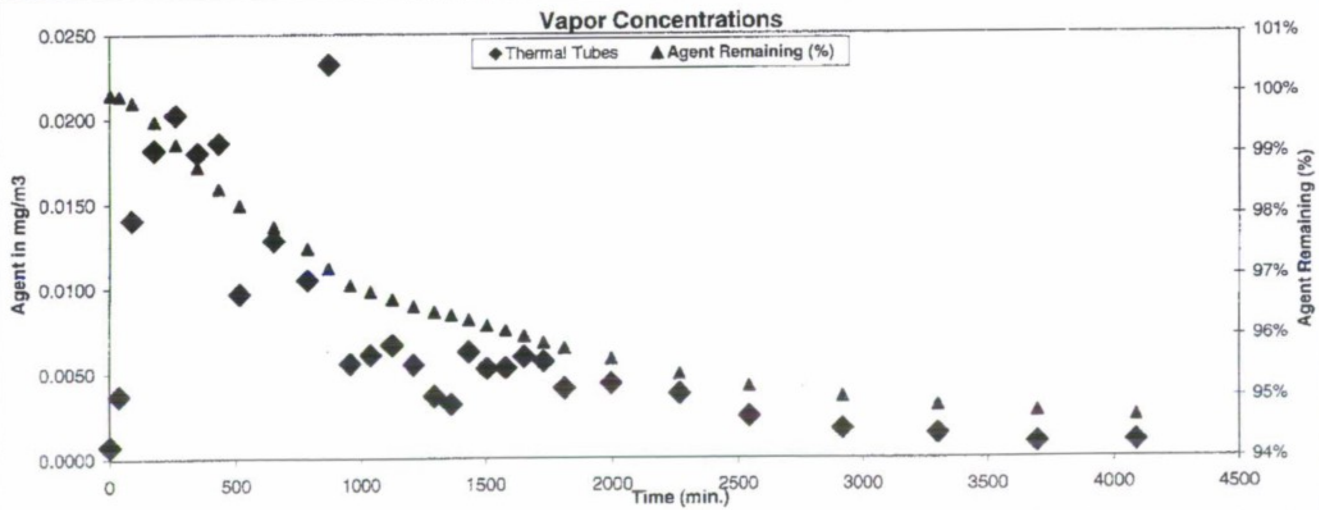


Time (min)	Conc. mg/m^3	Agent rem. (%)
4.32	2.24E-03	100.00%
42.70	2.28E-02	99.89%
97.75	3.26E-02	99.54%
186.13	2.54E-02	98.96%
274.50	3.53E-02	98.35%
362.88	3.94E-02	97.59%
451.27	3.57E-02	96.84%
539.65	3.20E-02	96.15%
678.03	2.99E-02	95.18%
816.42	2.19E-02	94.36%
907.30	1.88E-02	93.94%
1000.68	1.55E-02	93.57%
1094.07	1.41E-02	93.26%
1187.45	6.82E-03	93.03%
1280.83	5.99E-03	92.90%
1374.22	1.02E-02	92.73%
1453.43	3.96E-03	92.60%
1535.15	8.77E-03	92.48%
1616.87	5.47E-03	92.35%
1701.08	3.49E-03	92.26%
1787.80	6.27E-03	92.16%
1884.52	2.64E-03	92.07%
1991.23	2.88E-03	92.00%
2207.95	3.81E-03	91.83%
2518.00	2.69E-03	91.60%
2828.05	2.06E-03	91.43%
0.00	0.00E+00	92.10%
0.00	0.00E+00	92.10%
0.00	0.00E+00	92.10%
0.00	0.00E+00	92.10%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	01/17/07 152
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	48.91 °C
Average air flow rate:	19.00 SLPM
Average air temperature above drop:	48.80 °C
Mass % recovery in vapor:	5.3 %
Mass % recovery by extraction:	10.5 %
Total agent % mass recovery:	15.8 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

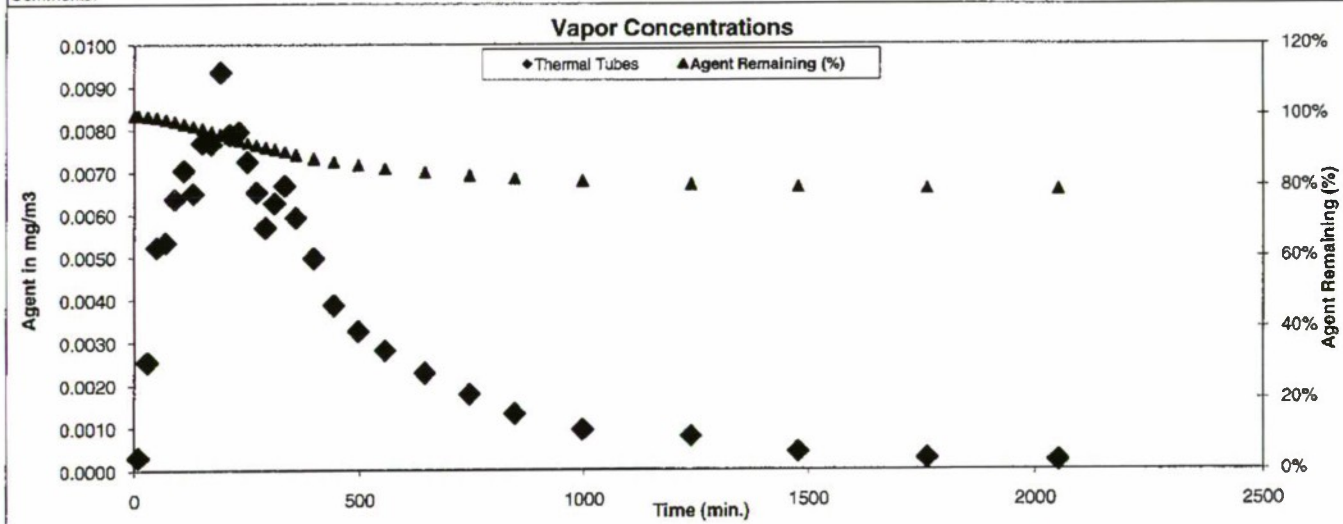
Raw evaporation rate: 0.31 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
2.60	7.14E-04	100.00%
37.65	3.69E-03	99.98%
89.37	1.41E-02	99.88%
174.42	1.82E-02	99.56%
259.45	2.02E-02	99.19%
344.50	1.80E-02	98.81%
429.55	1.86E-02	98.46%
514.60	9.69E-03	98.18%
649.65	1.28E-02	97.83%
784.70	1.05E-02	97.47%
869.75	2.32E-02	97.14%
954.80	5.57E-03	96.86%
1039.85	6.06E-03	96.74%
1124.88	6.65E-03	96.62%
1209.94	5.52E-03	96.50%
1295.00	3.67E-03	96.41%
1363.37	3.19E-03	96.36%
1432.58	6.26E-03	96.28%
1504.30	5.28E-03	96.19%
1577.69	5.31E-03	96.10%
1651.07	5.96E-03	96.00%
1728.62	5.68E-03	95.90%
1810.33	4.10E-03	95.81%
1994.55	4.36E-03	95.63%
2264.58	3.76E-03	95.38%
2544.63	2.43E-03	95.18%
2918.02	1.68E-03	95.00%
3301.40	1.42E-03	94.86%
3694.78	8.79E-04	94.76%
4088.17	9.29E-04	94.68%

Data Evaluation Grade: **Modeling Grade**

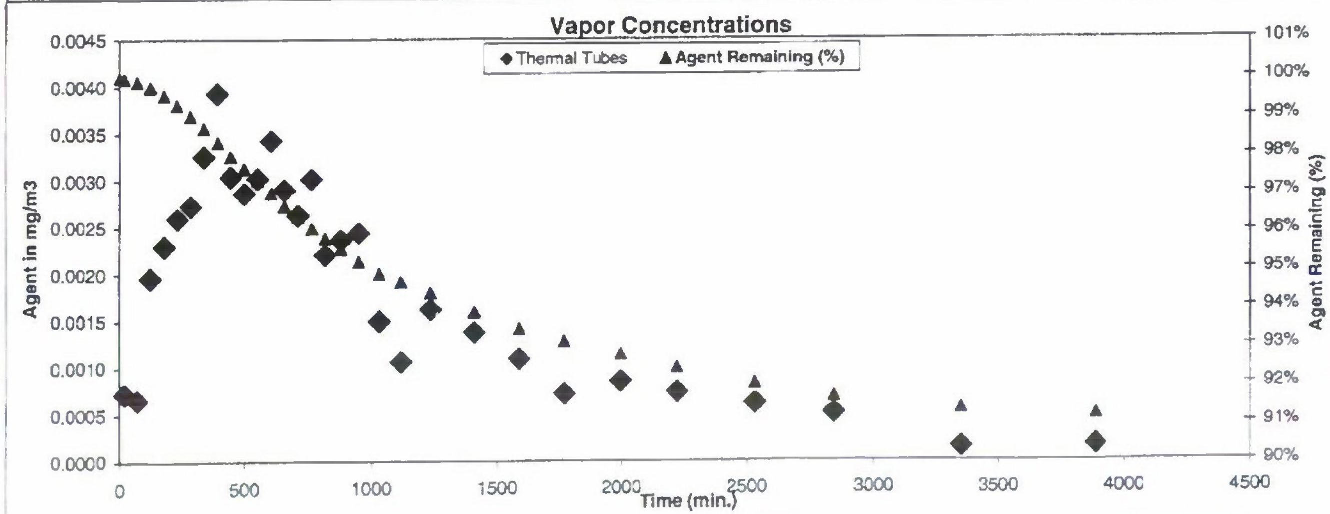
Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	03/05/07	61
Type of substrate :	UK Sand	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	48.39 °C	
Average air flow rate:	406.49 SLPM	
Average air temperature above drop:	49.68 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	20.8 %	
Mass % recovery in vapor:	21.1 %	
Total agent % mass recovery:	41.9 %	Raw evaporation rate: 3.1 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	



Time (min)	Conc. mg/m³	Agent rem. (%)
8.02	3.02E-04	99.99%
28.07	2.54E-03	99.85%
48.12	5.24E-03	99.47%
68.15	5.35E-03	98.95%
88.20	6.37E-03	98.37%
108.25	7.05E-03	97.71%
128.30	6.51E-03	97.04%
148.33	7.70E-03	96.34%
168.38	7.67E-03	95.59%
188.43	9.35E-03	94.75%
208.48	7.89E-03	93.90%
228.52	7.95E-03	93.12%
248.57	7.25E-03	92.37%
268.62	6.53E-03	91.69%
288.65	5.70E-03	91.09%
308.72	6.27E-03	90.50%
331.25	6.69E-03	89.78%
356.30	5.93E-03	89.00%
396.35	4.98E-03	87.93%
441.38	3.87E-03	86.95%
496.43	3.25E-03	85.99%
556.48	2.80E-03	85.10%
646.53	2.28E-03	83.97%
746.57	1.78E-03	82.97%
846.62	1.32E-03	82.21%
996.67	9.42E-04	81.38%
1236.72	7.83E-04	80.36%
1476.75	4.13E-04	79.66%
1763.47	2.61E-04	79.18%
2050.18	2.02E-04	78.86%

Data Evaluation Grade: **Test Grade (requires further evaluation)**

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	01/08/07	187
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	33.76 °C	
Average air flow rate:	18.03 SLPM	
Average air temperature above drop:	34.85 °C	
Mass % recovery in vapor:	8.8 %	
Mass % recovery by extraction:	8.2 %	
Total agent % mass recovery:	17.0 %	
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	Raw evaporation rate: 0.26 µg/min
Comments:	n/a	

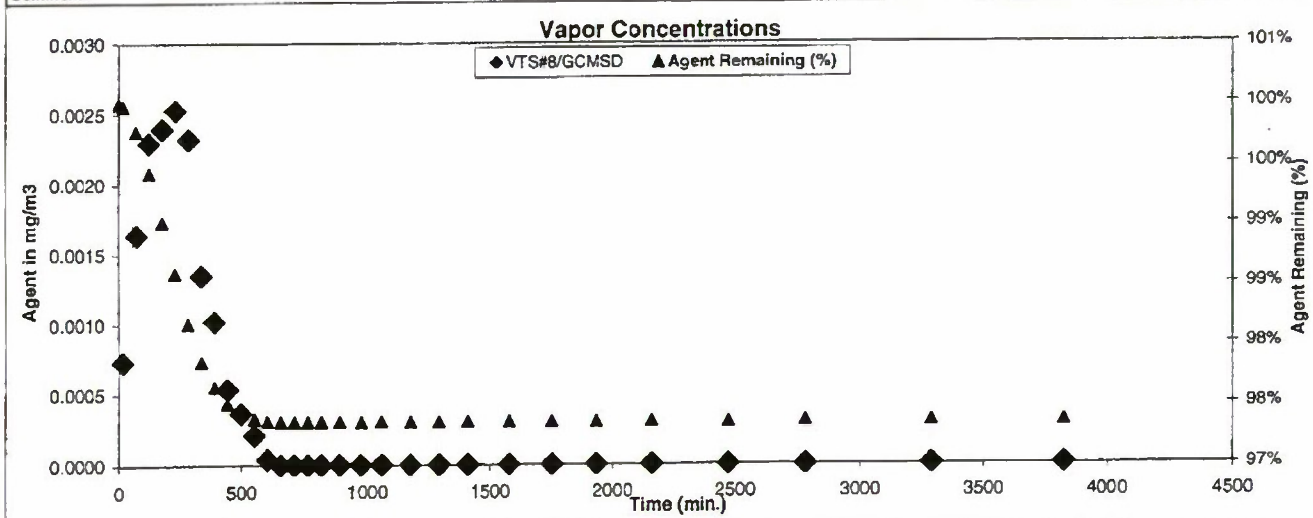


Time (min)	Conc. mg/m^3	Agent rem. (%)
18.88	7.20E-04	99.99%
72.25	8.57E-04	99.91%
125.63	1.96E-03	99.78%
179.02	2.30E-03	99.55%
232.40	2.60E-03	99.30%
285.76	2.73E-03	99.02%
339.15	3.26E-03	98.71%
392.53	3.93E-03	98.33%
445.90	3.04E-03	97.96%
499.28	2.87E-03	97.65%
552.66	3.02E-03	97.35%
606.05	3.43E-03	97.01%
659.42	2.90E-03	96.68%
712.80	2.63E-03	96.39%
766.18	3.02E-03	96.09%
819.56	2.21E-03	95.82%
881.28	2.36E-03	95.54%
951.32	2.44E-03	95.21%
1034.70	1.49E-03	94.89%
1118.08	1.06E-03	94.68%
1234.80	1.62E-03	94.38%
1409.83	1.36E-03	93.87%
1589.88	1.08E-03	93.43%
1769.93	7.09E-04	93.12%
1996.63	8.45E-04	92.77%
2223.35	7.27E-04	92.42%
2533.40	6.13E-04	92.01%
2843.45	5.08E-04	91.67%
3350.15	1.43E-04	91.35%
3886.87	1.56E-04	91.19%

1 Copy of 20061016_3a_140(000_16_2)VX_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3a			
Instruments:	VTS#8/GCMSD			
Date/Experiment #:	10/16/06	140		
Type of substrate :	UK Sand			
Test agent/purity:	VX	91.0%	Date/Chem:	KS
Number of drops:	1			
Nominal drop volume:	6	µL		
Mass of agent disseminated:	6.06	mg		
Corrected mass on 100% agent purity:	5.51	mg		
Average substrate temperature:	42.15	°C		
Average air flow rate:	179.92	SLPM		
Average air temperature above drop:	42.16	°C		
Mass % recovery in vapor:	2.6	%		
Mass % recovery by extraction:	n/a	%		
Total agent % mass recovery:	2.6	%		
Tube #s consistant:	Yes		Raw evaporation rate: 0.41 µg/min	
Daily CCV < +/- 15%:	Yes			
Comments:	n/a			



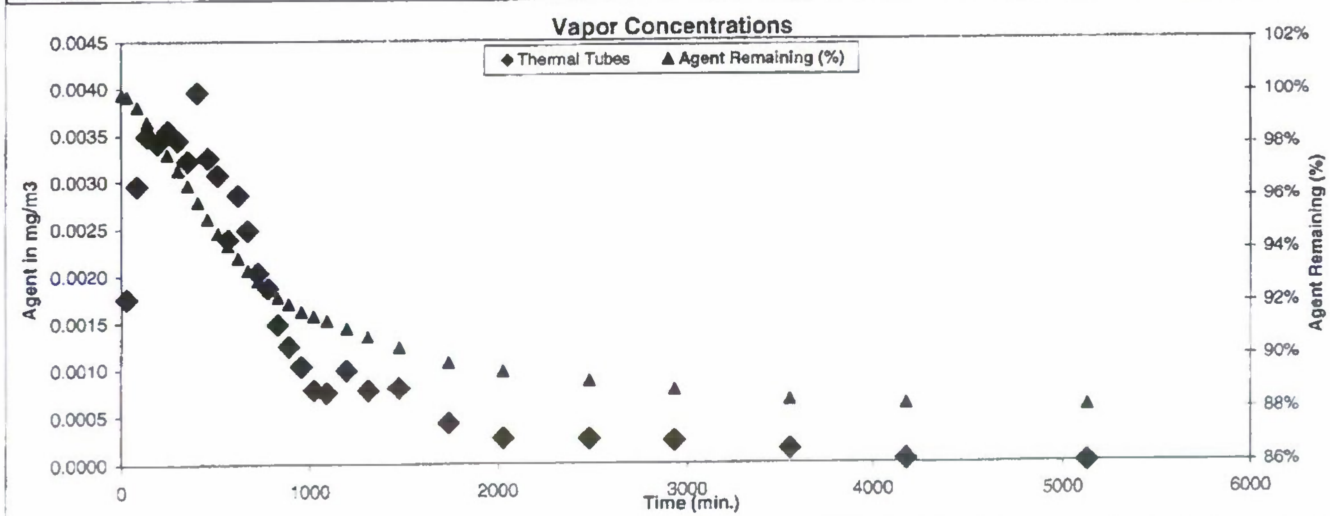
Time (min)	Conc. mg/m^3	Agent rem. (%)
17.88	7.31E-04	99.98%
71.27	1.64E-03	99.77%
124.65	2.30E-03	99.43%
178.03	2.40E-03	99.02%
231.42	2.53E-03	98.59%
284.78	2.32E-03	98.17%
338.17	1.35E-03	97.85%
391.55	1.02E-03	97.64%
444.93	5.37E-04	97.51%
498.32	3.65E-04	97.43%
551.70	2.10E-04	97.38%
605.08	4.01E-05	97.36%
658.47	0.00E+00	97.35%
711.85	0.00E+00	97.35%
765.21	0.00E+00	97.35%
818.61	0.00E+00	97.35%
893.67	0.00E+00	97.35%
977.05	0.00E+00	97.35%
1060.42	0.00E+00	97.35%
1177.13	0.00E+00	97.35%
1293.85	0.00E+00	97.35%
1410.57	0.00E+00	97.35%
1580.62	0.00E+00	97.35%
1755.67	0.00E+00	97.35%
1935.72	0.00E+00	97.35%
2162.43	0.00E+00	97.35%
2472.47	0.00E+00	97.35%
2782.52	0.00E+00	97.35%
3289.23	0.00E+00	97.35%
3825.95	0.00E+00	97.35%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	01/11/07 188
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	41.87 °C
Average air flow rate:	181.01 SLPM
Average air temperature above drop:	42.10 °C
Mass % recovery in vapor:	11.9 %
Mass % recovery by extraction:	4.6 %
Total agent % mass recovery:	16.5 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.63 µg/min

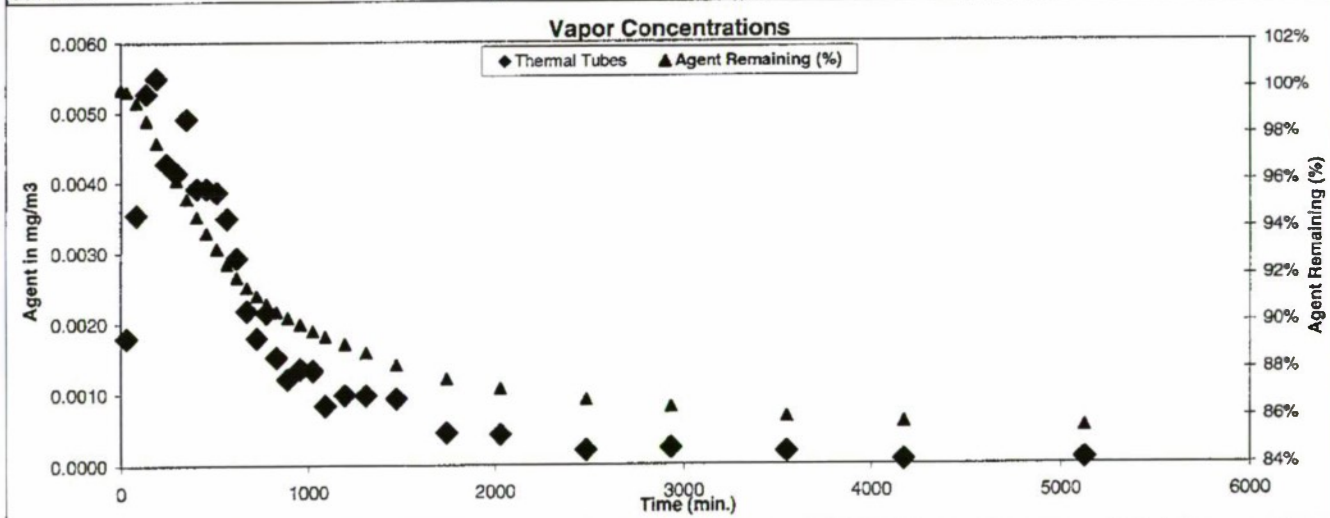
Time (min)	Conc. mg/m^3	Agent rem. (%)
28.81	1.75E-03	99.92%
82.20	2.95E-03	99.50%
135.58	3.49E-03	98.94%
188.97	3.41E-03	98.34%
242.33	3.55E-03	97.73%
295.72	3.44E-03	97.11%
349.10	3.22E-03	96.53%
402.47	3.95E-03	95.90%
455.85	3.25E-03	95.27%
509.23	3.07E-03	94.72%
562.62	2.38E-03	94.24%
615.98	2.85E-03	93.78%
669.37	2.48E-03	93.31%
722.75	2.03E-03	92.92%
776.12	1.87E-03	92.58%
829.52	1.48E-03	92.28%
889.55	1.24E-03	92.02%
956.27	1.03E-03	91.77%
1022.99	7.79E-04	91.57%
1089.70	7.51E-04	91.40%
1196.40	9.83E-04	91.10%
1309.78	7.77E-04	90.77%
1473.17	7.99E-04	90.35%
1739.87	4.29E-04	89.81%
2026.58	2.69E-04	89.48%
2479.97	2.55E-04	89.09%
2933.35	2.31E-04	88.73%
3553.38	1.41E-04	88.35%
4173.43	3.15E-05	88.18%
5126.82	0.00E+00	88.13%



Data Evaluation Grade: Modeling Grade

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	01/11/07	151
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	40.88	°C
Average air flow rate:	181.75	SLPM
Average air temperature above drop:	42.80	°C
Mass % recovery in vapor:	14.4	%
Mass % recovery by extraction:	5.1	%
Total agent % mass recovery:	19.6	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.83 µg/min



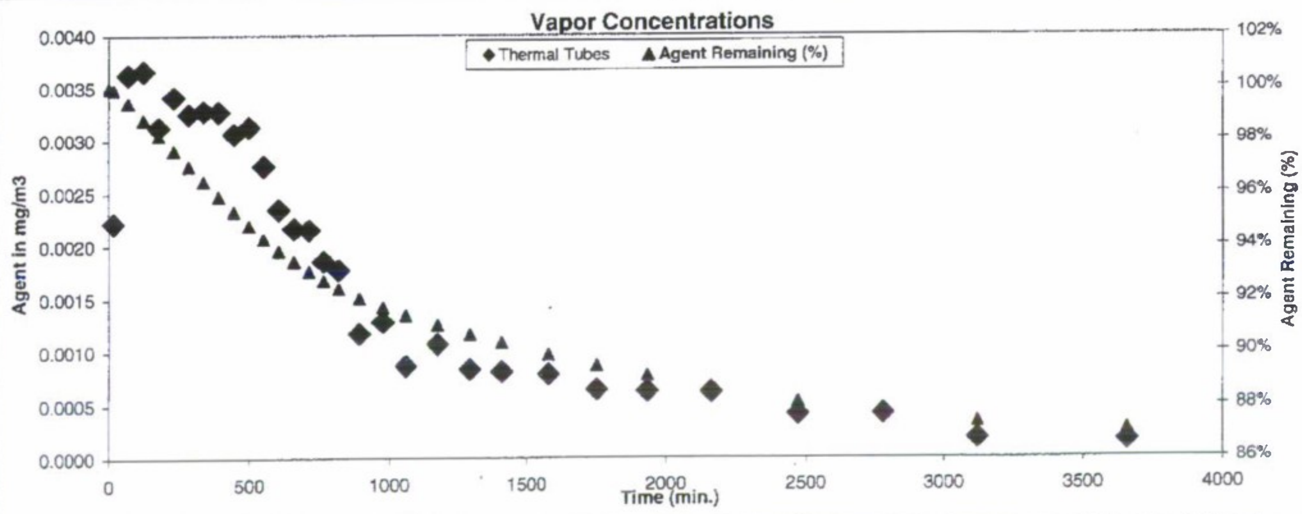
Time (min)	Conc. mg/m³	Agent rem. (%)
28.30	1.80E-03	99.92%
81.68	3.55E-03	99.45%
135.05	5.27E-03	98.67%
188.43	5.49E-03	97.72%
241.82	4.28E-03	96.86%
295.20	4.14E-03	96.12%
348.58	4.91E-03	95.33%
401.97	3.92E-03	94.55%
455.35	3.91E-03	93.86%
508.73	3.86E-03	93.18%
562.12	3.49E-03	92.53%
615.48	2.93E-03	91.97%
668.87	2.18E-03	91.52%
722.25	1.79E-03	91.17%
775.63	2.15E-03	90.82%
829.02	1.52E-03	90.50%
889.07	1.21E-03	90.23%
955.79	1.35E-03	89.95%
1022.50	1.33E-03	89.66%
1089.22	8.34E-04	89.42%
1195.93	9.85E-04	89.10%
1309.32	9.75E-04	88.73%
1472.68	9.31E-04	88.22%
1739.40	4.47E-04	87.61%
2026.12	4.23E-04	87.20%
2479.50	2.02E-04	86.74%
2932.88	2.29E-04	86.41%
3552.93	1.79E-04	86.00%
4172.98	5.24E-05	85.76%
5126.37	7.04E-05	85.57%

4 Copy of 20061023_3c_179(000_a_1)VX_Suk.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#9/GCMSD
Date/Experiment #:	10/23/06 179
Type of substrate :	UK Sand
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	41.52 °C
Average air flow rate:	181.40 SLPM
Average air temperature above drop:	41.95 °C
Mass % recovery in vapor:	12.9 %
Mass % recovery by extraction:	0.6 %
Total agent % mass recovery:	13.6 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.60 µg/min

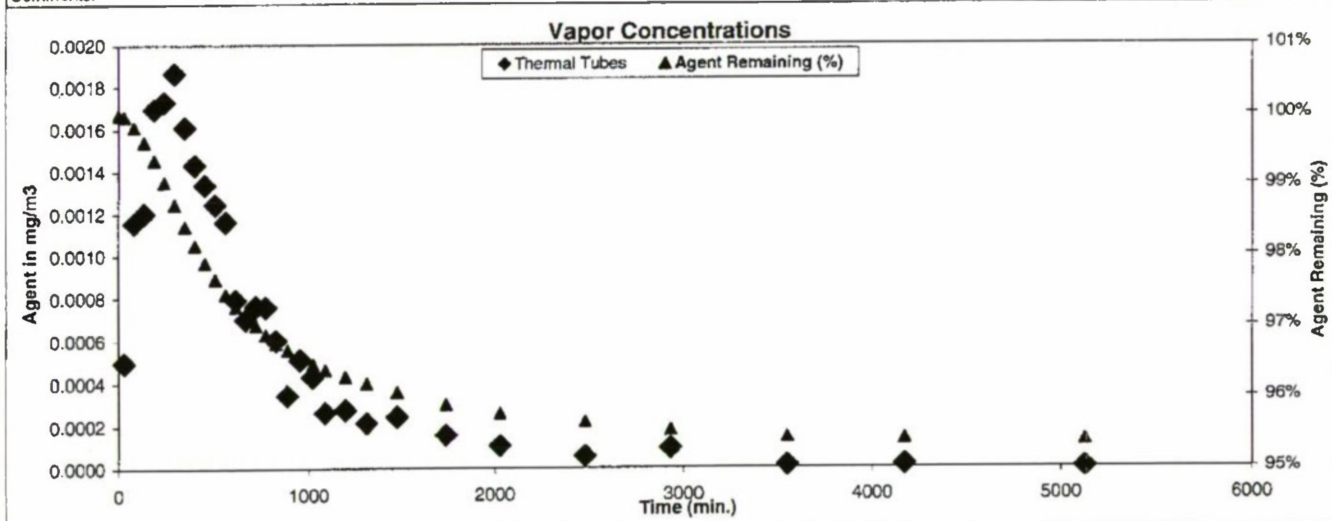


Time (min)	Conc. mg/m^3	Agent rem. (%)
17.85	2.22E-03	99.93%
71.23	3.63E-03	99.42%
124.60	3.66E-03	98.78%
177.98	3.12E-03	98.19%
231.37	3.41E-03	97.61%
284.75	3.25E-03	97.03%
338.11	3.28E-03	96.45%
391.50	3.27E-03	95.88%
444.88	3.06E-03	95.32%
498.27	3.13E-03	94.78%
551.63	2.76E-03	94.26%
605.01	2.35E-03	93.81%
658.40	2.17E-03	93.42%
711.77	2.15E-03	93.04%
765.15	1.86E-03	92.69%
818.53	1.77E-03	92.37%
893.58	1.17E-03	92.00%
976.97	1.28E-03	91.67%
1060.35	8.65E-04	91.37%
1177.05	1.07E-03	91.00%
1293.77	8.34E-04	90.64%
1410.48	8.10E-04	90.32%
1580.52	7.86E-04	89.88%
1755.57	6.40E-04	89.46%
1935.62	6.25E-04	89.09%
2162.33	6.18E-04	88.63%
2472.37	4.06E-04	88.10%
2782.42	4.14E-04	87.69%
3122.47	1.78E-04	87.36%
3659.17	1.58E-04	87.06%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	12/22/06	185
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.42	mg
Average substrate temperature:	42.88	°C
Average air flow rate:	181.53	SLPM
Average air temperature above drop:	42.12	°C
Mass % recovery in vapor:	4.6	%
Mass % recovery by extraction:	n/a	%
Total agent % mass recovery:	4.6	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.29 µg/min

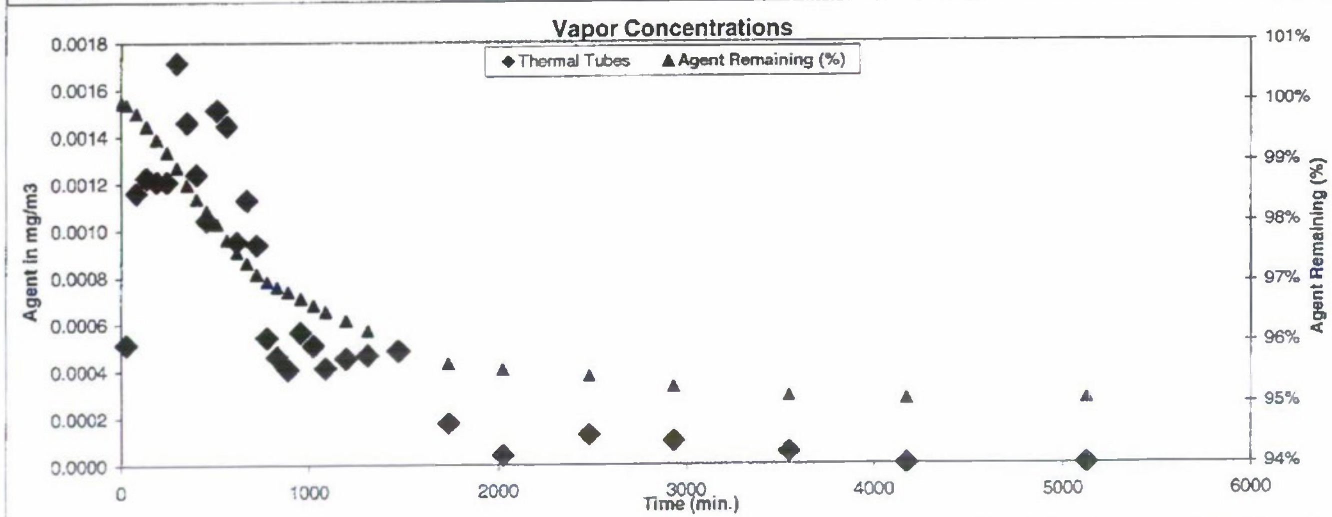


Time (min)	Conc. mg/m³	Agent rem. (%)
28.07	4.96E-04	99.98%
81.45	1.16E-03	99.83%
134.81	1.20E-03	99.62%
188.20	1.69E-03	99.36%
241.58	1.73E-03	99.05%
294.97	1.86E-03	98.73%
348.33	1.61E-03	98.42%
401.71	1.43E-03	98.15%
455.10	1.34E-03	97.90%
508.47	1.24E-03	97.67%
561.85	1.16E-03	97.46%
615.23	7.91E-04	97.28%
668.61	7.00E-04	97.15%
721.98	7.62E-04	97.02%
775.37	7.57E-04	96.88%
828.75	6.02E-04	96.76%
888.80	3.43E-04	96.66%
955.52	5.10E-04	96.57%
1022.22	4.31E-04	96.46%
1088.93	2.62E-04	96.39%
1195.65	2.74E-04	96.29%
1309.03	2.13E-04	96.20%
1472.40	2.42E-04	96.07%
1739.12	1.55E-04	95.90%
2025.83	1.04E-04	95.77%
2479.20	5.46E-05	95.65%
2932.58	9.31E-05	95.54%
3552.63	1.07E-05	95.43%
4172.68	1.40E-05	95.41%
5126.05	0.00E+00	95.38%

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	12/28/06	186
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	42.16	°C
Average air flow rate:	181.52	SLPM
Average air temperature above drop:	42.12	°C
Mass % recovery in vapor:	4.9	%
Mass % recovery by extraction:	0.7	%
Total agent % mass recovery:	5.6	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.24 µg/min

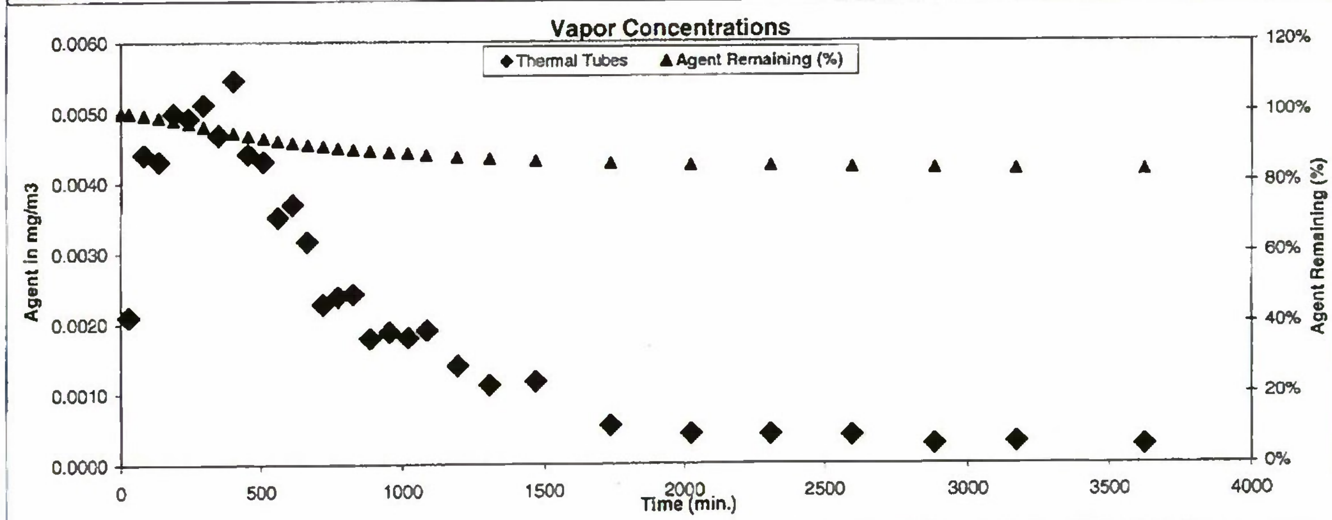


Time (min)	Conc. mg/m^3	Agent rem. (%)
27.62	5.12E-04	99.98%
80.98	1.16E-03	99.83%
134.36	1.23E-03	99.62%
187.75	1.21E-03	99.41%
241.13	1.21E-03	99.19%
294.50	1.71E-03	98.94%
347.88	1.46E-03	98.66%
401.26	1.24E-03	98.42%
454.65	1.04E-03	98.22%
508.01	1.51E-03	98.00%
561.40	1.44E-03	97.74%
614.78	9.52E-04	97.53%
668.15	1.13E-03	97.34%
721.53	9.38E-04	97.16%
774.92	5.41E-04	97.03%
828.30	4.60E-04	96.94%
888.35	4.05E-04	96.86%
955.05	5.63E-04	96.75%
1021.77	5.08E-04	96.63%
1088.48	4.12E-04	96.53%
1195.20	4.52E-04	96.38%
1308.57	4.65E-04	96.21%
1471.95	4.84E-04	95.95%
1738.67	1.77E-04	95.66%
2025.38	3.81E-05	95.56%
2478.75	1.25E-04	95.44%
2932.13	9.82E-05	95.28%
3552.18	5.05E-05	95.12%
4172.23	0.00E+00	95.07%
5125.60	0.00E+00	95.07%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	01/22/07	190
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.33 °C	
Average air flow rate:	181.50 SLPM	
Average air temperature above drop:	41.46 °C	
Mass % recovery in vapor:	16.8 %	
Mass % recovery by extraction:	n/a %	
Total agent % mass recovery:	16.8 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.83 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

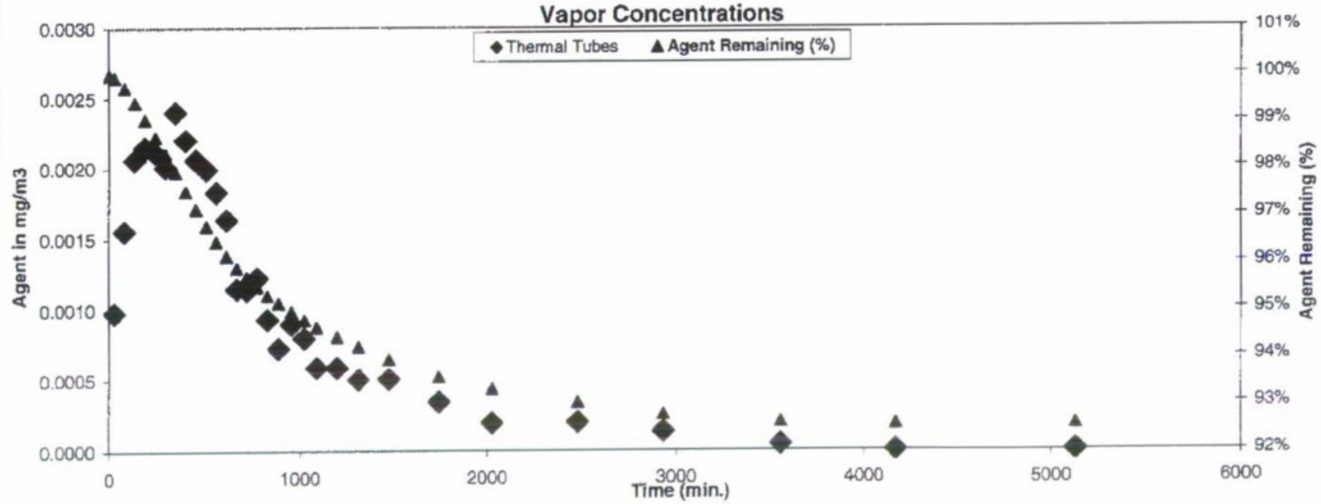
Time (min)	Conc. mg/m^3	Agent rem. (%)
26.72	2.10E-03	99.91%
80.10	4.40E-03	99.34%
133.47	4.31E-03	98.57%
186.85	4.99E-03	97.76%
240.23	4.92E-03	96.89%
293.60	5.11E-03	96.00%
346.98	4.68E-03	95.14%
400.37	5.45E-03	94.26%
453.75	4.41E-03	93.39%
507.12	4.30E-03	92.62%
560.50	3.51E-03	91.94%
613.88	3.69E-03	91.31%
667.27	3.16E-03	90.71%
720.63	2.27E-03	90.23%
774.02	2.38E-03	89.82%
827.40	2.41E-03	89.40%
887.45	1.78E-03	88.98%
954.17	1.87E-03	88.58%
1020.87	1.79E-03	88.18%
1087.59	1.90E-03	87.78%
1194.30	1.40E-03	87.20%
1307.68	1.12E-03	86.73%
1471.05	1.16E-03	86.12%
1737.77	5.41E-04	85.37%
2024.48	4.18E-04	84.92%
2311.20	4.12E-04	84.52%
2597.90	3.88E-04	84.15%
2884.62	2.64E-04	83.84%
3171.33	2.93E-04	83.58%
3624.70	2.50E-04	83.17%



Data Evaluation Grade: Modeling Grade

Tunnel:	3L
Instruments:	VTS#10/GCMSD
Date/Experiment #:	12/22/06 43
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.22 °C
Average air flow rate:	181.53 SLPM
Average air temperature above drop:	42.25 °C
Mass % recovery in vapor:	7.4 %
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	7.4 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.39 µg/min

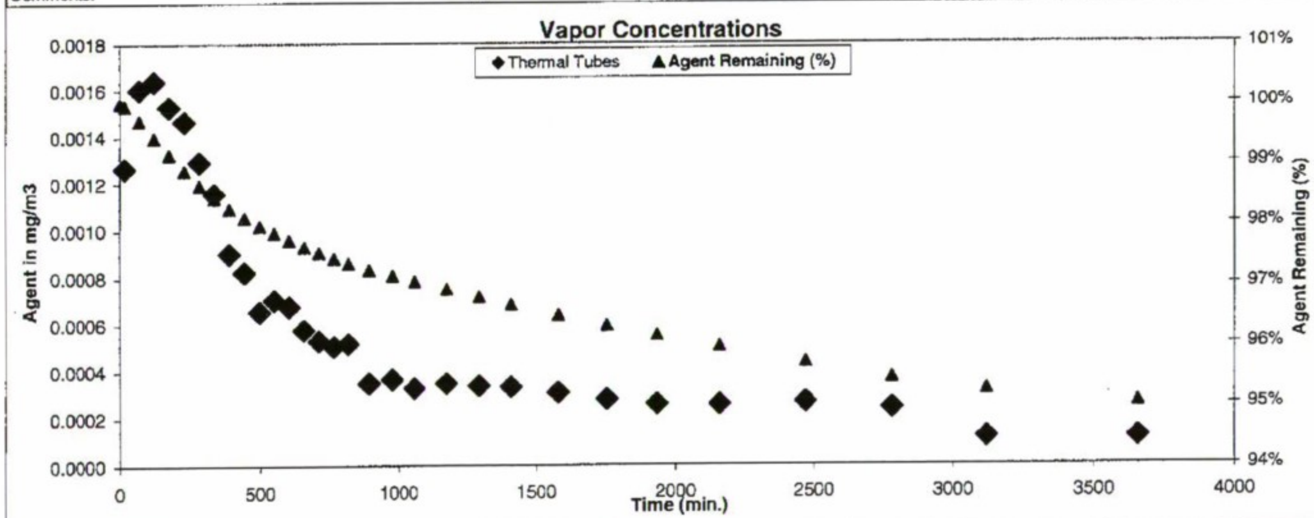


Time (min)	Conc. mg/m^3	Agent rem. (%)
29.16	9.78E-04	99.95%
82.55	1.56E-03	99.73%
135.93	2.06E-03	99.41%
189.31	2.15E-03	99.04%
242.70	2.11E-03	98.67%
296.08	2.01E-03	98.31%
349.47	2.40E-03	97.92%
402.85	2.20E-03	97.51%
456.23	2.06E-03	97.14%
509.62	1.99E-03	96.78%
563.00	1.83E-03	96.45%
616.36	1.64E-03	96.14%
669.75	1.15E-03	95.90%
723.13	1.14E-03	95.70%
776.51	1.22E-03	95.49%
829.91	9.28E-04	95.30%
889.97	7.26E-04	95.14%
956.68	8.96E-04	94.96%
1023.40	7.95E-04	94.77%
1090.10	5.86E-04	94.62%
1196.82	5.88E-04	94.41%
1310.20	5.03E-04	94.21%
1473.58	5.05E-04	93.94%
1740.30	3.44E-04	93.57%
2027.02	1.96E-04	93.31%
2480.40	2.00E-04	93.02%
2933.78	1.31E-04	92.77%
3553.83	4.15E-05	92.60%
4173.88	0.00E+00	92.55%
5127.27	0.00E+00	92.55%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#8/GCMSD
Date/Experiment #:	10/23/06 142
Type of substrate :	UK Sand
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.04 °C
Average air flow rate:	181.60 SLPM
Average air temperature above drop:	42.17 °C
Mass % recovery in vapor:	5.0 %
Mass % recovery by extraction:	0.7 %
Total agent % mass recovery:	5.6 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.24 µg/min

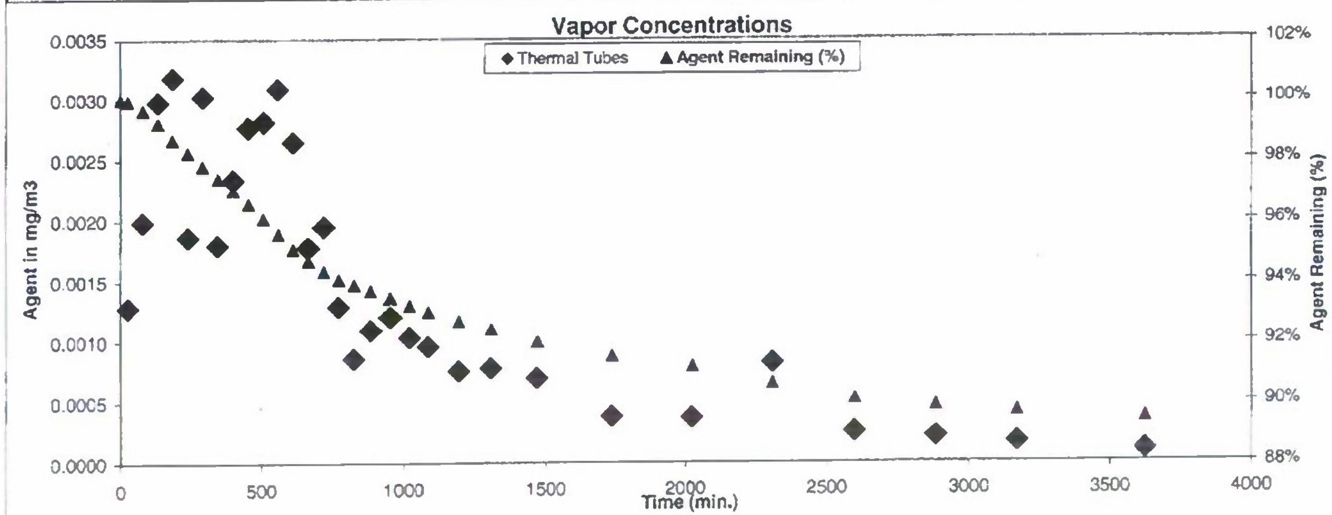


Time (min)	Conc. mg/m^3	Agent rem. (%)
16.73	1.27E-03	99.97%
70.12	1.60E-03	99.71%
123.48	1.64E-03	99.43%
176.87	1.53E-03	99.15%
230.25	1.47E-03	98.89%
283.63	1.29E-03	98.64%
337.02	1.16E-03	98.43%
390.40	9.03E-04	98.25%
443.78	8.23E-04	98.10%
497.17	6.54E-04	97.97%
550.55	7.02E-04	97.85%
603.93	6.76E-04	97.73%
657.30	5.76E-04	97.62%
710.68	5.29E-04	97.52%
764.07	5.04E-04	97.43%
817.47	5.17E-04	97.34%
892.50	3.47E-04	97.23%
975.88	3.63E-04	97.13%
1059.27	3.26E-04	97.04%
1175.98	3.45E-04	96.91%
1292.70	3.36E-04	96.78%
1409.42	3.30E-04	96.65%
1579.47	3.06E-04	96.47%
1754.52	2.77E-04	96.31%
1934.57	2.57E-04	96.15%
2161.27	2.55E-04	95.96%
2471.32	2.64E-04	95.69%
2781.37	2.38E-04	95.44%
3121.42	1.15E-04	95.24%
3658.13	1.15E-04	95.03%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	01/22/07	153
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	41.73	°C
Average air flow rate:	181.63	SLPM
Average air temperature above drop:	41.94	°C
Mass % recovery in vapor:	10.5	%
Mass % recovery by extraction:	n/a	%
Total agent % mass recovery:	10.5	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

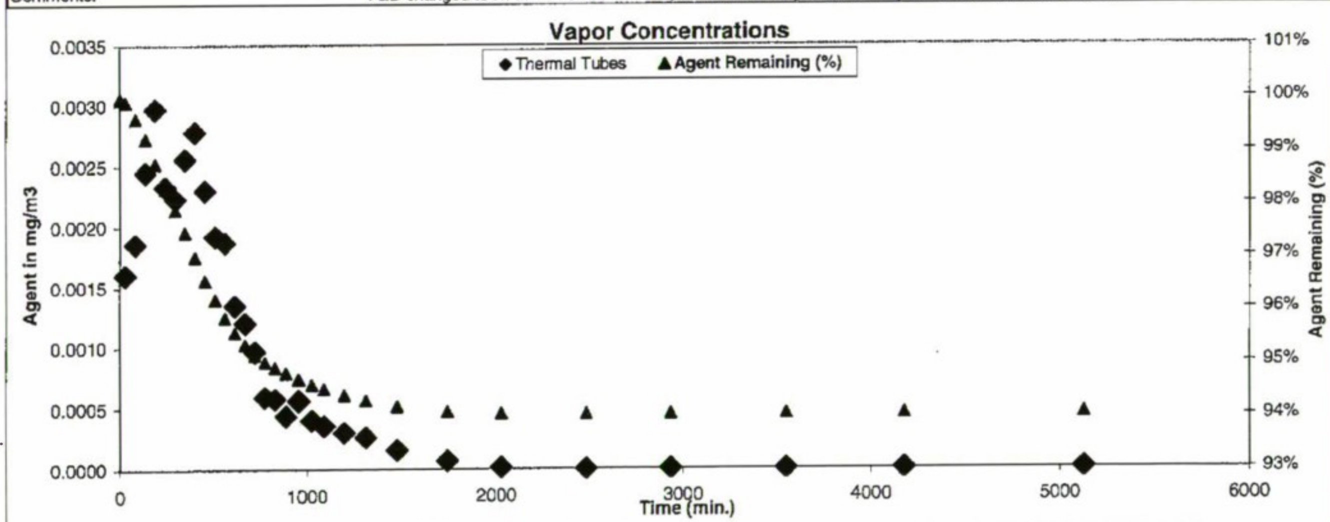
Raw evaporation rate: 0.45 µg/min



Time (min)	Conc. mg/m³	Agent rem. (%)
26.70	1.28E-03	99.94%
80.08	1.99E-03	99.66%
133.46	2.98E-03	99.22%
186.85	3.18E-03	98.68%
240.23	1.86E-03	98.23%
293.61	3.02E-03	97.80%
347.00	1.80E-03	97.38%
400.37	2.34E-03	97.02%
453.75	2.77E-03	96.57%
507.13	2.81E-03	96.08%
560.51	3.09E-03	95.56%
613.90	2.65E-03	95.05%
667.28	1.78E-03	94.67%
720.66	1.95E-03	94.34%
774.05	1.28E-03	94.05%
827.43	8.52E-04	93.87%
887.49	1.09E-03	93.67%
954.20	1.20E-03	93.42%
1020.92	1.03E-03	93.18%
1087.62	9.55E-04	92.96%
1194.33	7.52E-04	92.66%
1307.72	7.76E-04	92.37%
1471.10	6.93E-04	91.98%
1737.82	3.78E-04	91.51%
2024.53	3.66E-04	91.16%
2311.25	8.21E-04	90.60%
2597.97	2.53E-04	90.09%
2884.67	2.12E-04	89.87%
3171.38	1.70E-04	89.69%
3624.77	9.67E-05	89.49%

Data Evaluation Grade: Not for modeling

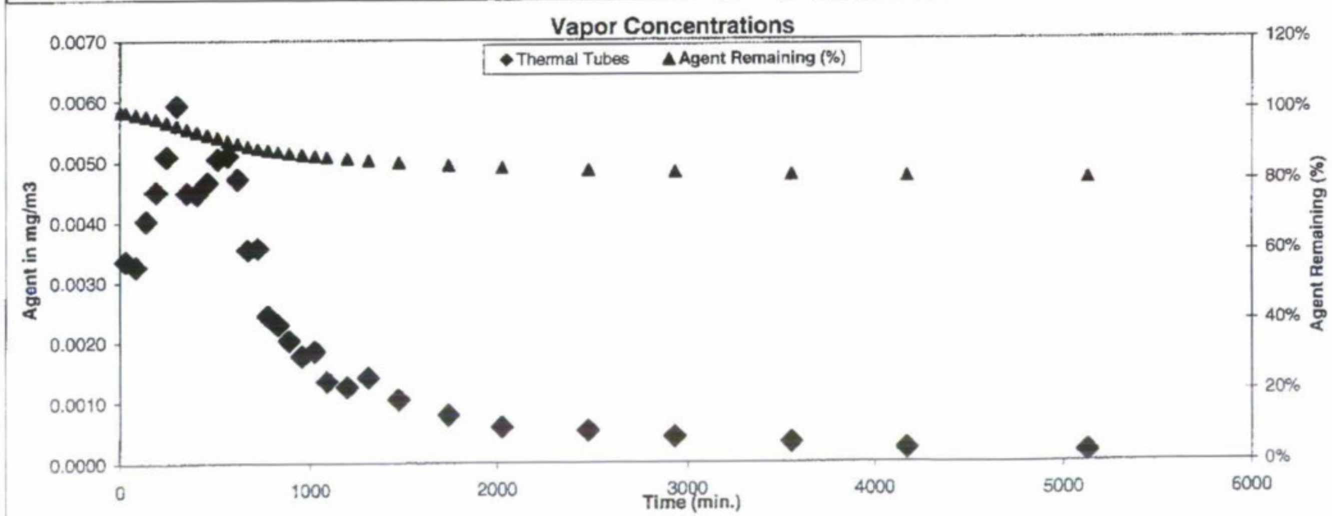
Tunnel:	3L	
Instruments:	VTS#3/GCMSD	
Date/Experiment #:	12/28/06	44
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.22 °C	
Average air flow rate:	181.60 SLPM	
Average air temperature above drop:	42.21 °C	
Mass % recovery in vapor:	6.0 %	
Mass % recovery by extraction:	0.6 %	
Total agent % mass recovery:	6.5 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.45 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	TGD changed to NFM - VTS had low flow, VX stock ran dry, sandcastling noted visually, but not in video	



Time (min)	Conc. mg/m^3	Agent rem. (%)
29.12	1.60E-03	99.92%
82.50	1.86E-03	99.62%
135.88	2.45E-03	99.24%
189.27	2.97E-03	98.76%
242.65	2.33E-03	98.30%
296.03	2.23E-03	97.90%
349.41	2.56E-03	97.48%
402.80	2.78E-03	97.01%
456.18	2.30E-03	96.56%
509.57	1.92E-03	96.19%
562.95	1.87E-03	95.85%
616.33	1.35E-03	95.57%
669.72	1.20E-03	95.35%
723.10	9.67E-04	95.16%
776.48	5.94E-04	95.02%
829.87	5.80E-04	94.92%
889.92	4.39E-04	94.82%
956.63	5.66E-04	94.70%
1023.35	4.06E-04	94.60%
1090.07	3.58E-04	94.51%
1196.78	3.01E-04	94.40%
1310.17	2.63E-04	94.29%
1473.55	1.57E-04	94.18%
1740.27	6.58E-05	94.08%
2026.98	9.76E-06	94.05%
2480.37	0.00E+00	94.04%
2933.75	0.00E+00	94.04%
3553.80	0.00E+00	94.04%
4173.85	0.00E+00	94.04%
5127.22	0.00E+00	94.04%

Data Evaluation Grade: **Test Grade (requires further evaluation)**

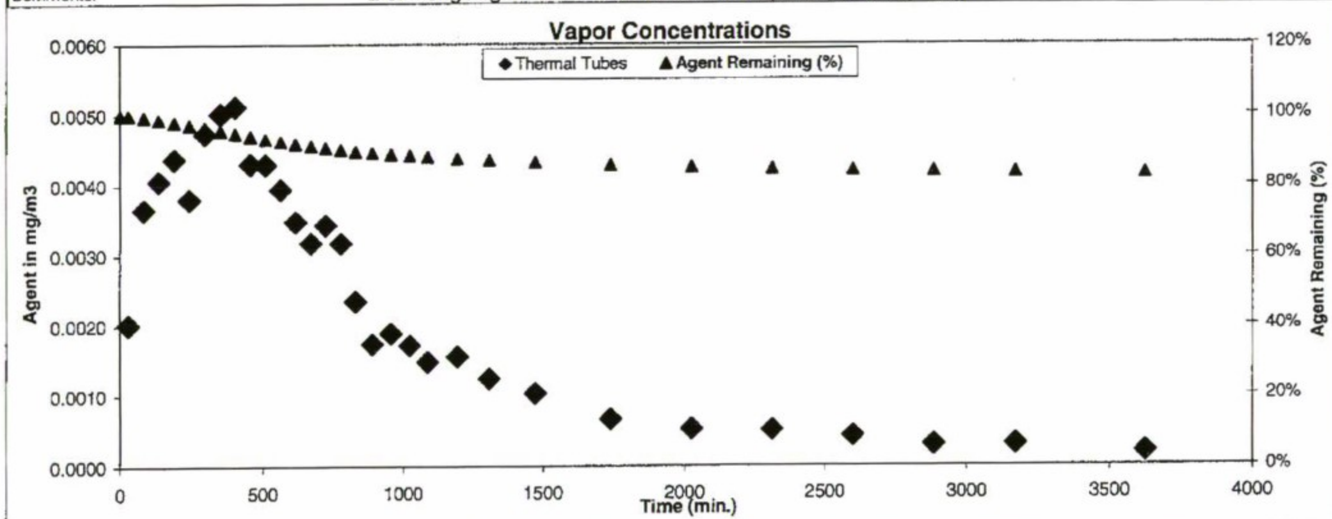
Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	01/11/07	46
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.11 °C	
Average air flow rate:	181.56 SLPM	
Average air temperature above drop:	42.15 °C	
Mass % recovery in vapor:	19.5 %	
Mass % recovery by extraction:	4.3 %	
Total agent % mass recovery:	23.7 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.87 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	1 out of 3 ongoing CCVs above 30% (141%) - cvg	



Time (min)	Conc. mg/m^3	Agent rem. (%)
29.27	3.36E-03	99.84%
82.65	3.26E-03	99.26%
136.03	4.03E-03	98.62%
189.42	4.51E-03	97.87%
242.80	5.09E-03	97.02%
296.18	5.93E-03	96.05%
349.57	4.49E-03	95.14%
402.95	4.47E-03	94.35%
456.33	4.66E-03	93.55%
509.71	5.05E-03	92.69%
563.10	5.10E-03	91.80%
616.48	4.72E-03	90.94%
669.86	3.54E-03	90.21%
723.25	3.57E-03	89.58%
776.63	2.44E-03	89.06%
830.01	2.29E-03	88.64%
890.07	2.03E-03	88.21%
956.79	1.77E-03	87.80%
1023.50	1.85E-03	87.40%
1090.22	1.35E-03	87.05%
1196.93	1.25E-03	86.59%
1310.32	1.41E-03	86.09%
1473.70	1.05E-03	85.43%
1740.42	7.95E-04	84.62%
2027.13	5.86E-04	83.97%
2480.52	5.24E-04	83.14%
2933.90	4.16E-04	82.44%
3553.95	3.23E-04	81.69%
4174.00	2.19E-04	81.13%
5127.38	1.66E-04	80.53%

Data Evaluation Grade: **Test Grade (requires further evaluation)**

Tunnel:	3L	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	01/22/07	49
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.06 °C	
Average air flow rate:	181.62 SLPM	
Average air temperature above drop:	41.79 °C	
Mass % recovery in vapor:	16.8 %	
Mass % recovery by extraction:	n/a %	
Total agent % mass recovery:	16.8 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.75 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	2 of 4 ongoing CCVs were outside +/-30% (55% and 64%) - cvg	

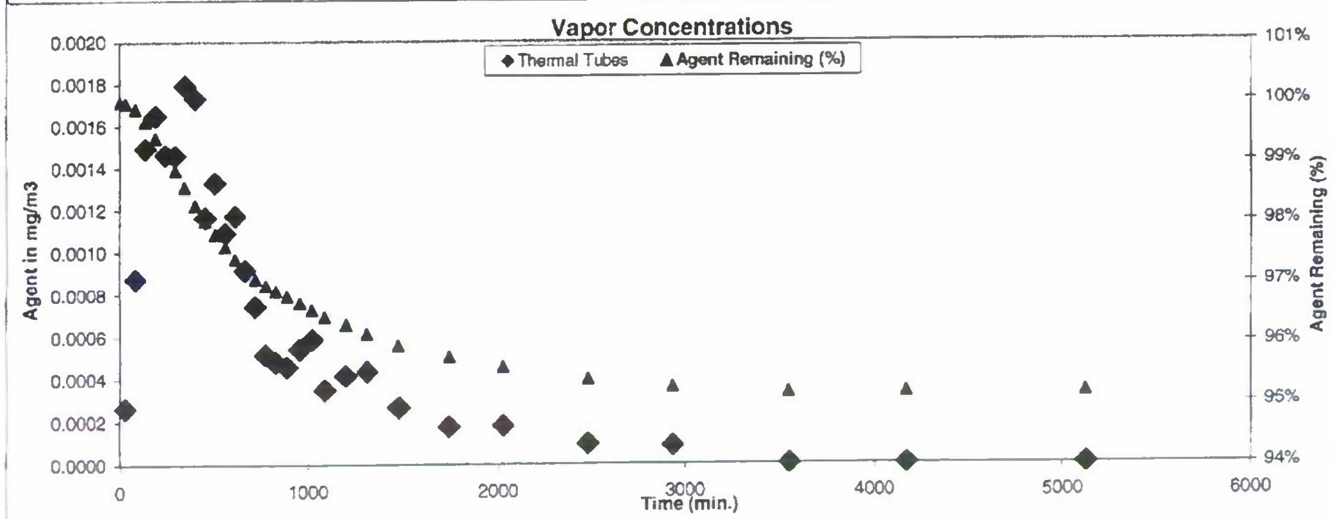


Time (min)	Conc. mg/m^3	Agent rem. (%)
28.47	2.02E-03	99.91%
81.85	3.66E-03	99.41%
135.23	4.06E-03	98.73%
188.62	4.37E-03	97.99%
242.00	3.80E-03	97.27%
295.38	4.74E-03	96.52%
348.77	5.02E-03	95.66%
402.15	5.12E-03	94.77%
455.53	4.30E-03	93.94%
508.92	4.30E-03	93.18%
562.30	3.94E-03	92.46%
615.68	3.48E-03	91.81%
669.07	3.18E-03	91.22%
722.45	3.44E-03	90.64%
775.83	3.17E-03	90.06%
829.22	2.34E-03	89.58%
889.27	1.73E-03	89.17%
955.99	1.89E-03	88.78%
1022.70	1.71E-03	88.38%
1089.42	1.48E-03	88.03%
1196.12	1.55E-03	87.50%
1309.50	1.24E-03	86.98%
1472.88	1.02E-03	86.37%
1739.60	6.59E-04	85.63%
2026.32	5.15E-04	85.08%
2313.03	5.05E-04	84.60%
2599.75	4.18E-04	84.16%
2886.47	2.90E-04	83.83%
3173.18	2.96E-04	83.55%
3626.57	1.89E-04	83.19%

Data Evaluation Grade: **Test Grade (requires further evaluation)**

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	12/22/06	45
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.19 °C	
Average air flow rate:	181.70 SLPM	
Average air temperature above drop:	41.83 °C	
Mass % recovery in vapor:	4.8 %	
Mass % recovery by extraction:	n/a %	
Total agent % mass recovery:	4.8 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.28 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	1 of 4 ongoing ccvs outisde +/-30% (143%) - cvg	

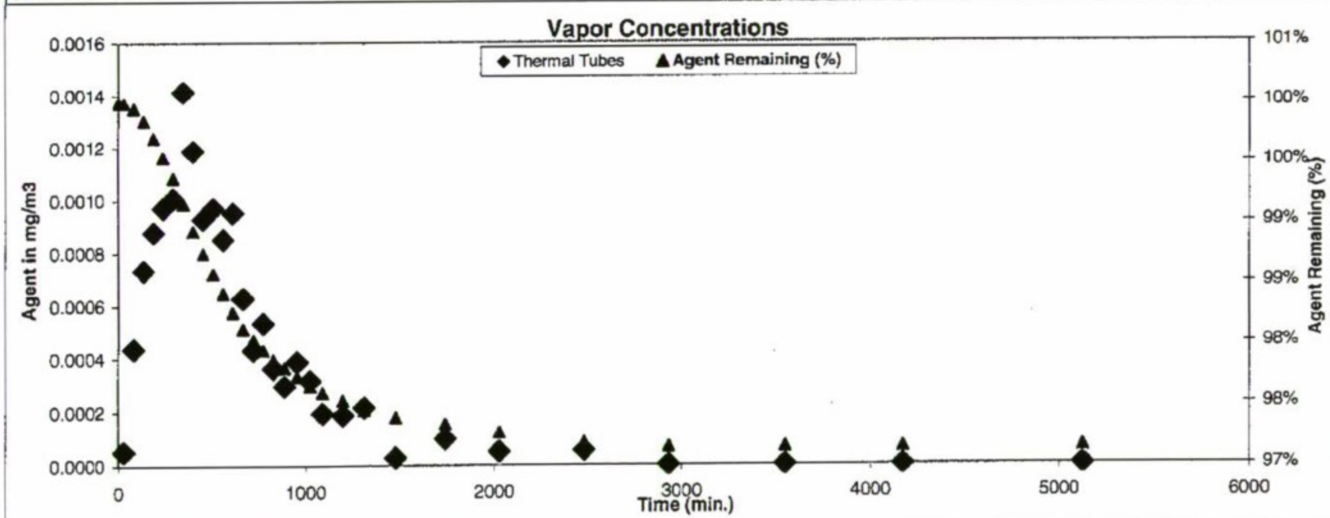
Time (min)	Conc. mg/m^3	Agent rem. (%)
28.97	2.62E-04	99.99%
82.35	8.75E-04	99.89%
135.73	1.49E-03	99.68%
189.12	1.65E-03	99.40%
242.50	1.46E-03	99.13%
295.88	1.46E-03	98.87%
349.27	1.79E-03	98.59%
402.65	1.73E-03	98.28%
456.03	1.16E-03	98.02%
509.42	1.33E-03	97.80%
562.78	1.09E-03	97.59%
616.17	1.17E-03	97.39%
669.55	9.16E-04	97.21%
722.93	7.45E-04	97.08%
776.32	5.13E-04	96.95%
829.71	4.79E-04	96.86%
889.77	4.56E-04	96.77%
956.47	5.39E-04	96.66%
1023.19	5.86E-04	96.54%
1089.90	3.45E-04	96.43%
1196.62	4.14E-04	96.30%
1310.00	4.33E-04	96.14%
1473.38	2.64E-04	95.95%
1740.10	1.73E-04	95.76%
2026.82	1.79E-04	95.60%
2480.20	9.72E-05	95.39%
2933.58	8.19E-05	95.26%
3553.63	0.00E+00	95.17%
4173.68	0.00E+00	95.17%
5127.07	0.00E+00	95.17%



Data Evaluation Grade: Test Grade (requires further evaluation)

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	12/22/06 148
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.05 °C
Average air flow rate:	181.78 SLPM
Average air temperature above drop:	42.09 °C
Mass % recovery in vapor:	2.9 %
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	2.9 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 0.19 µg/min



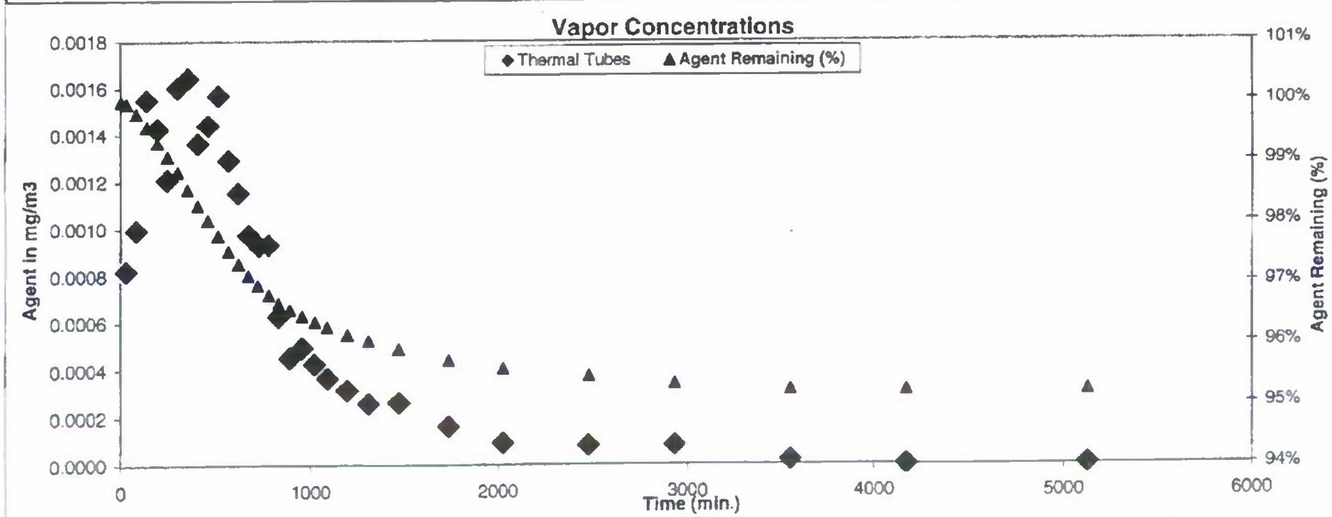
Time (min)	Conc. mg/m³	Agent rem. (%)
27.98	5.19E-05	100.00%
81.35	4.38E-04	99.95%
134.73	7.35E-04	99.85%
188.12	8.78E-04	99.71%
241.50	9.70E-04	99.55%
294.88	1.01E-03	99.37%
348.26	1.41E-03	99.16%
401.65	1.19E-03	98.93%
455.03	9.28E-04	98.75%
508.41	9.69E-04	98.58%
561.78	8.51E-04	98.42%
615.17	9.51E-04	98.26%
668.55	6.27E-04	98.12%
721.93	4.31E-04	98.03%
775.31	5.33E-04	97.94%
828.70	3.62E-04	97.86%
888.75	2.94E-04	97.80%
955.47	3.86E-04	97.72%
1022.18	3.15E-04	97.65%
1088.90	1.92E-04	97.59%
1195.62	1.85E-04	97.53%
1308.98	2.14E-04	97.45%
1472.37	2.60E-05	97.39%
1739.08	9.64E-05	97.33%
2025.80	5.01E-05	97.26%
2479.18	5.28E-05	97.19%
2932.57	0.00E+00	97.15%
3552.62	0.00E+00	97.15%
4172.67	0.00E+00	97.15%
5126.05	0.00E+00	97.15%

7 Copy of 20061228_3a_149(000_a_2)VX_Suk.xls

Data Evaluation Grade: **Test Grade (requires further evaluation)**

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	12/28/06	149
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	41.57 °C	
Average air flow rate:	181.75 SLPM	
Average air temperature above drop:	42.03 °C	
Mass % recovery in vapor:	4.8 %	
Mass % recovery by extraction:	0.7 %	
Total agent % mass recovery:	5.5 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.25 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

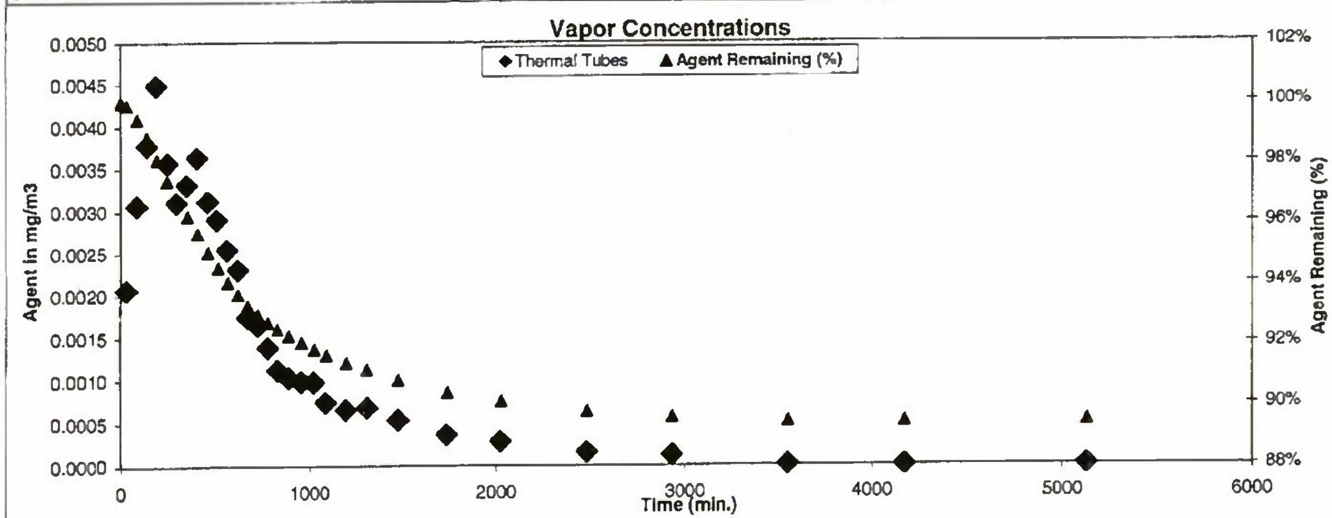
Time (min)	Conc. mg/m³	Agent rem. (%)
28.15	8.21E-04	99.96%
81.53	9.95E-04	99.80%
134.92	1.55E-03	99.58%
188.28	1.43E-03	99.32%
241.67	1.21E-03	99.08%
295.05	1.60E-03	98.84%
348.43	1.64E-03	98.55%
401.82	1.36E-03	98.29%
455.20	1.44E-03	98.04%
508.58	1.57E-03	97.78%
561.97	1.29E-03	97.52%
615.35	1.15E-03	97.31%
668.72	9.75E-04	97.12%
722.10	9.30E-04	96.95%
775.48	9.33E-04	96.79%
828.86	6.26E-04	96.65%
888.92	4.51E-04	96.55%
955.64	4.93E-04	96.44%
1022.35	4.24E-04	96.34%
1089.07	3.64E-04	96.26%
1195.78	3.13E-04	96.14%
1309.17	2.56E-04	96.03%
1472.55	2.62E-04	95.89%
1739.27	1.62E-04	95.70%
2025.97	9.15E-05	95.58%
2479.35	8.13E-05	95.46%
2932.73	8.18E-05	95.33%
3552.78	1.74E-05	95.23%
4172.83	0.00E+00	95.21%
5126.22	0.00E+00	95.21%



Data Evaluation Grade: **Test Grade (requires further evaluation)**

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	12/28/06	46
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.28 °C	
Average air flow rate:	181.76 SLPM	
Average air temperature above drop:	41.90 °C	
Mass % recovery in vapor:	10.6 %	
Mass % recovery by extraction:	0.6 %	
Total agent % mass recovery:	11.2 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.65 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	1 of 4 ongoing ccvs outside +/-30% (165%) - cvg	

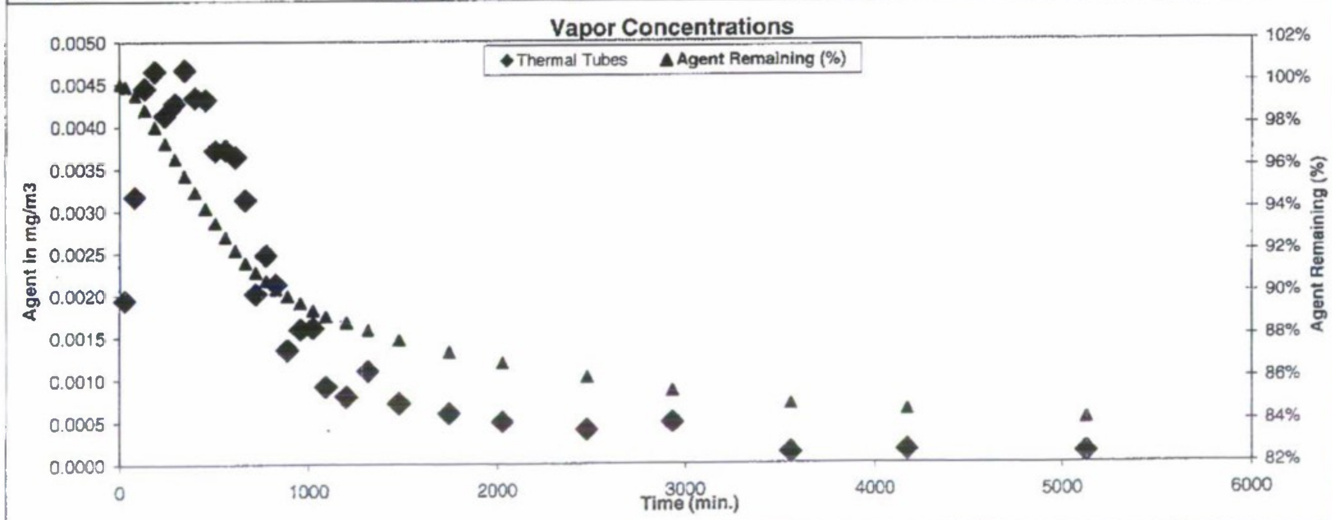
Time (min)	Conc. mg/m³	Agent rem. (%)
28.68	2.07E-03	99.90%
82.07	3.07E-03	99.45%
135.45	3.77E-03	98.85%
188.83	4.48E-03	98.12%
242.22	3.57E-03	97.41%
295.60	3.10E-03	96.83%
348.98	3.31E-03	96.26%
402.37	3.63E-03	95.65%
455.75	3.12E-03	95.06%
509.13	2.90E-03	94.53%
562.50	2.54E-03	94.05%
615.90	2.31E-03	93.62%
669.27	1.74E-03	93.27%
722.65	1.65E-03	92.97%
776.03	1.39E-03	92.70%
829.44	1.13E-03	92.48%
889.49	1.03E-03	92.27%
956.20	9.84E-04	92.05%
1022.90	9.81E-04	91.83%
1089.62	7.40E-04	91.64%
1196.33	6.55E-04	91.39%
1309.72	6.82E-04	91.14%
1473.10	5.41E-04	90.82%
1739.82	3.64E-04	90.42%
2026.53	2.79E-04	90.11%
2479.92	1.56E-04	89.79%
2933.30	1.18E-04	89.58%
3553.35	9.30E-06	89.45%
4173.40	0.00E+00	89.45%
5126.78	0.00E+00	89.45%



3 Copy of 20070111_3k_048(000_a_1)VXtc_Suk-NFM.xls

Data Evaluation Grade: Not for Modeling

Tunnel:	3K	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	01/11/07	48
Type of substrate :	Sand(UK)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	41.59 °C	
Average air flow rate:	181.75 SLPM	
Average air temperature above drop:	41.88 °C	
Mass % recovery in vapor:	15.9 %	
Mass % recovery by extraction:	4.0 %	
Total agent % mass recovery:	19.9 %	
Tube #s consistant:	Yes	Raw evaporation rate: 0.74 µg/min
Daily CCV < +/- 15%:	Yes	
Comments:	All ongoing CCVs out of range	

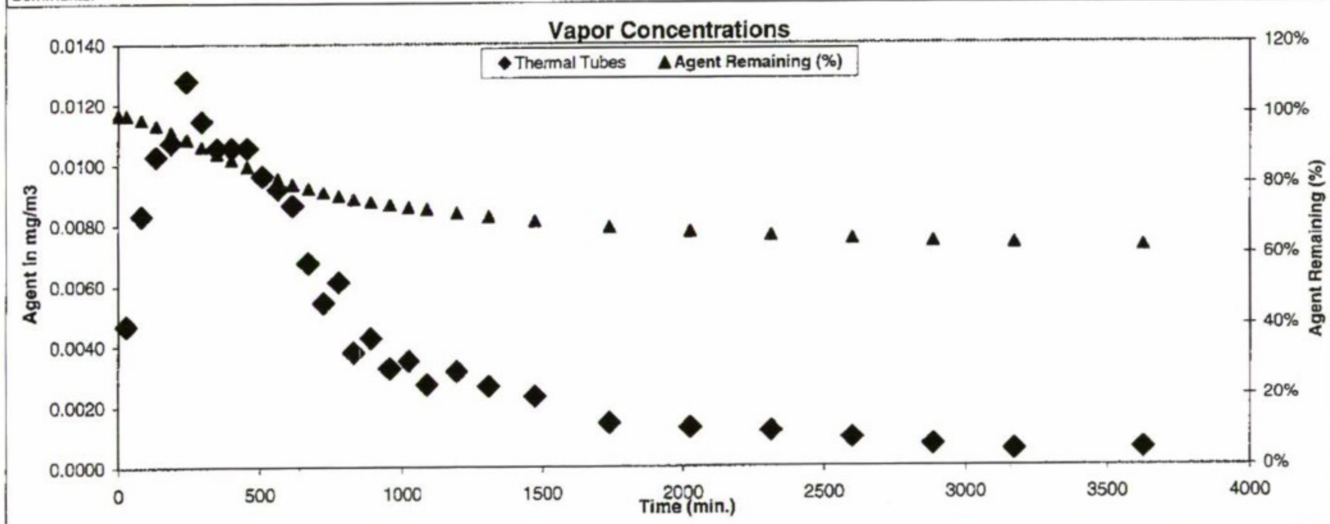


Time (min)	Conc. mg/m^3	Agent rem. (%)
28.81	1.94E-03	99.91%
82.20	3.17E-03	99.46%
135.58	4.45E-03	98.79%
188.95	4.65E-03	97.99%
242.33	4.13E-03	97.21%
295.71	4.27E-03	96.48%
349.10	4.67E-03	95.69%
402.48	4.34E-03	94.90%
455.86	4.32E-03	94.14%
509.25	3.72E-03	93.43%
562.63	3.72E-03	92.77%
616.02	3.64E-03	92.13%
669.40	3.13E-03	91.53%
722.78	2.01E-03	91.08%
776.17	2.47E-03	90.68%
829.55	2.13E-03	90.28%
889.60	1.35E-03	89.93%
956.32	1.59E-03	89.61%
1023.04	1.61E-03	89.26%
1089.75	9.16E-04	88.98%
1196.47	7.96E-04	88.68%
1309.85	1.10E-03	88.33%
1473.23	7.18E-04	87.84%
1739.95	5.93E-04	87.26%
2026.67	4.91E-04	86.75%
2480.05	3.97E-04	86.08%
2933.43	4.87E-04	85.42%
3553.48	1.26E-04	84.80%
4173.53	1.51E-04	84.51%
5126.92	1.21E-04	84.09%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3K
Instruments:	VTS#11/GCMSD
Date/Experiment #:	01/22/07 51
Type of substrate :	Sand(UK)
Test agent/purity:	VX
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	39.92 °C
Average air flow rate:	181.77 SLPM
Average air temperature above drop:	40.92 °C
Mass % recovery in vapor:	37.8 %
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	37.8 %
Tube #s consistant:	Yes
Daily CCV < +/- 15%:	Yes
Comments:	n/a

Raw evaporation rate: 2 µg/min



Time (min)	Conc. mg/m³	Agent rem. (%)
28.53	4.68E-03	99.78%
81.92	8.32E-03	98.64%
135.30	1.03E-02	97.00%
188.68	1.07E-02	95.15%
242.07	1.28E-02	93.08%
295.43	1.15E-02	90.95%
348.82	1.06E-02	89.01%
402.20	1.06E-02	87.15%
455.58	1.06E-02	85.29%
508.97	9.63E-03	83.52%
562.35	9.19E-03	81.86%
615.73	8.66E-03	80.29%
669.12	6.74E-03	78.93%
722.50	5.42E-03	77.86%
775.88	6.12E-03	76.85%
829.26	3.79E-03	75.98%
889.32	4.26E-03	75.18%
956.04	3.26E-03	74.35%
1022.75	3.50E-03	73.61%
1089.47	2.72E-03	72.93%
1196.18	3.15E-03	71.90%
1309.57	2.65E-03	70.81%
1472.95	2.31E-03	69.47%
1739.67	1.43E-03	67.83%
2026.38	1.26E-03	66.56%
2313.10	1.16E-03	65.41%
2599.82	9.33E-04	64.42%
2886.53	7.01E-04	63.65%
3173.25	5.29E-04	63.07%
3626.63	5.72E-04	62.24%

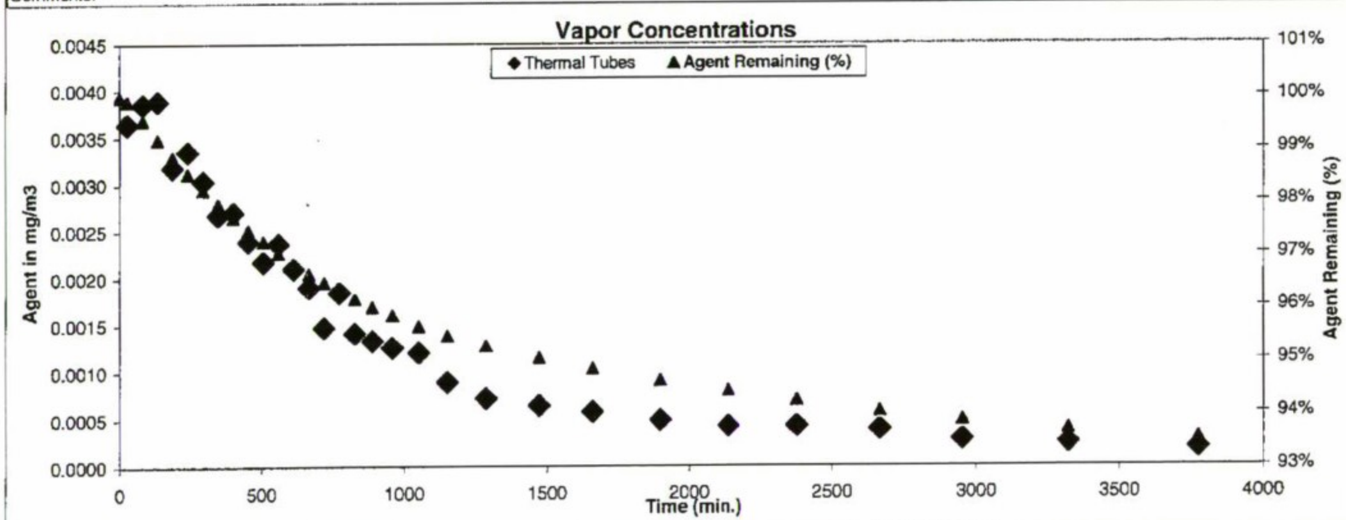
APPENDIX B

VX ON CONCRETE WIND TUNNEL DATA

3 Copy of VXC01E3c_LLLL_194_2007-02-05.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	02/05/07	194
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	36.02 °C	
Average air flow rate:	16.37 SLPM	
Average air temperature above drop:	35.25 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	0.0 %	
Total agent % mass recovery:	6.5 %	
Mass % recovery in vapor:	6.5 %	Raw Evaporation rate: 0.051 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

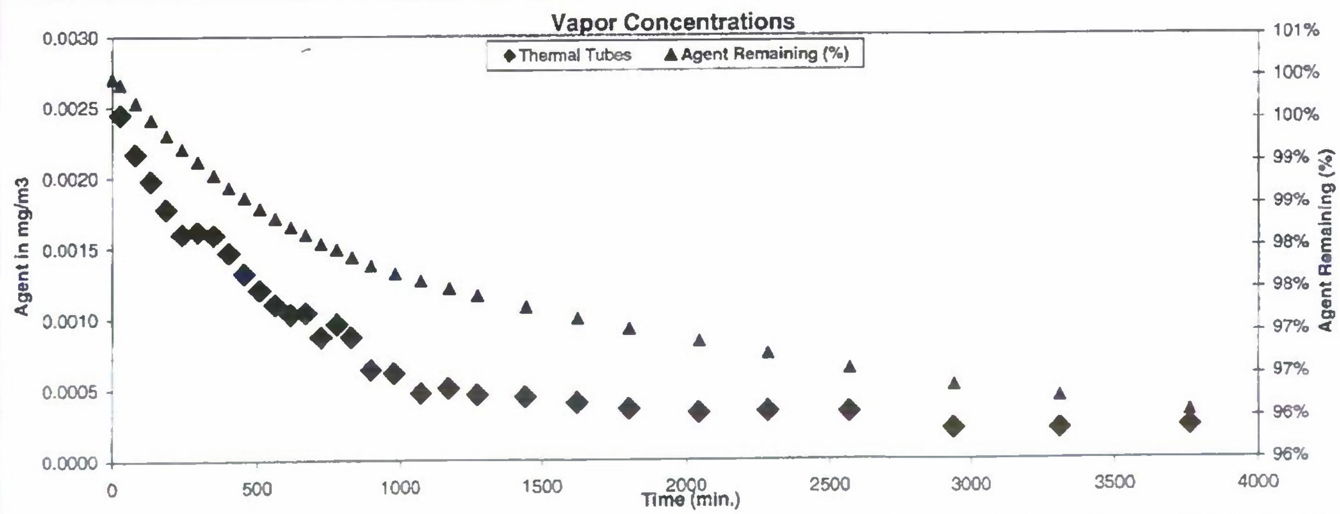


Time (min)	Conc. mg/m^3	Agent rem. (%)
26.45	3.64E-03	99.91%
79.82	3.85E-03	99.56%
133.20	3.88E-03	99.19%
186.58	3.18E-03	98.85%
239.97	3.35E-03	98.54%
293.33	3.03E-03	98.24%
346.72	2.68E-03	97.97%
400.10	2.70E-03	97.71%
453.47	2.39E-03	97.47%
506.85	2.18E-03	97.25%
560.23	2.37E-03	97.04%
613.62	2.10E-03	96.82%
666.98	1.90E-03	96.63%
720.37	1.47E-03	96.47%
773.75	1.84E-03	96.32%
827.13	1.41E-03	96.16%
888.85	1.33E-03	96.01%
958.89	1.26E-03	95.85%
1050.60	1.21E-03	95.65%
1150.65	8.94E-04	95.46%
1285.68	7.20E-04	95.27%
1472.40	6.42E-04	95.04%
1659.12	5.74E-04	94.84%
1899.17	4.88E-04	94.61%
2139.20	4.18E-04	94.42%
2379.25	4.22E-04	94.24%
2685.97	3.83E-04	94.03%
2952.68	2.76E-04	93.86%
3322.72	2.38E-04	93.70%
3776.10	1.83E-04	93.53%

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	02/12/07 196
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	34.95 °C
Average air flow rate:	16.53 SLPM
Average air temperature above drop:	35.15 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	5.0 %
Total agent % mass recovery:	9.0 %
Mass % recovery in vapor:	3.9 %
Tube #s consistant:	Yes
Comments:	no measurable video information - tgd

Raw Evaporation rate: 0.028 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
28.12	2.45E-03	99.94%
81.51	2.17E-03	99.72%
134.90	1.98E-03	99.52%
188.30	1.78E-03	99.34%
241.70	1.60E-03	99.18%
295.10	1.62E-03	99.02%
348.48	1.59E-03	98.87%
401.88	1.47E-03	98.72%
455.28	1.32E-03	98.59%
508.66	1.20E-03	98.47%
562.07	1.10E-03	98.35%
615.46	1.03E-03	98.25%
668.87	1.04E-03	98.15%
722.25	8.71E-04	98.06%
775.65	9.59E-04	97.97%
829.05	8.69E-04	97.89%
897.45	6.38E-04	97.79%
980.85	6.15E-04	97.70%
1072.57	4.74E-04	97.61%
1172.63	5.08E-04	97.52%
1272.70	4.61E-04	97.43%
1442.75	4.44E-04	97.30%
1622.78	4.01E-04	97.16%
1802.83	3.55E-04	97.04%
2042.88	3.30E-04	96.89%
2282.92	3.40E-04	96.74%
2569.63	3.33E-04	96.57%
2939.68	2.23E-04	96.38%
3309.73	2.13E-04	96.24%
3763.10	2.31E-04	96.06%

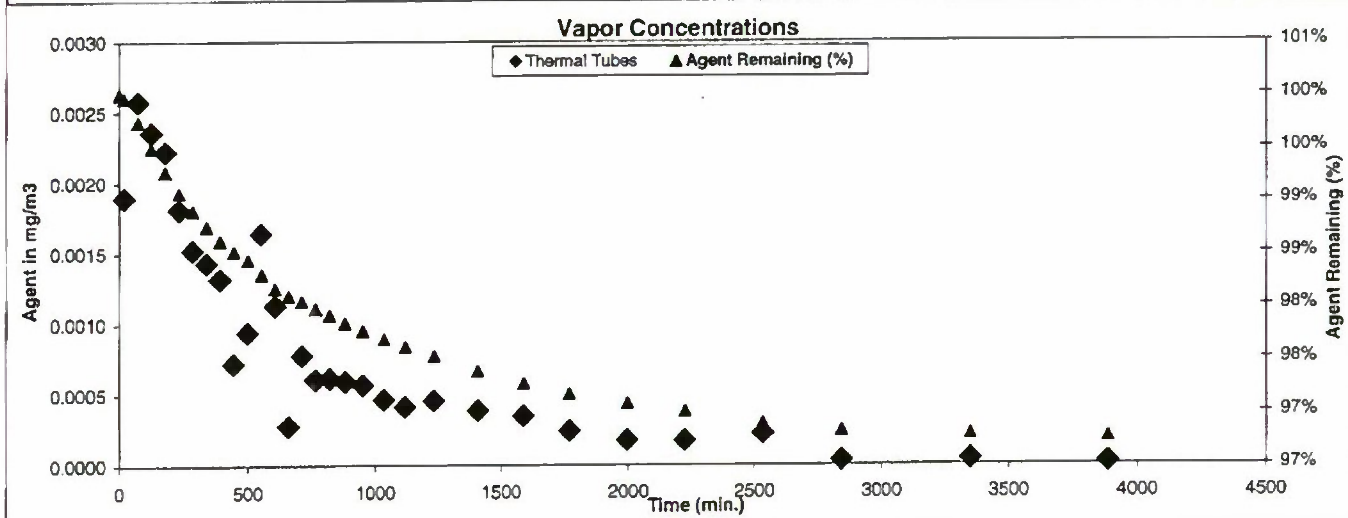
2 Copy of VXC01E3c_LHHL_192_2007-01-29.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	01/29/07	192
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	1	µL
Mass of agent disseminated:	1.01	mg
Corrected mass on 100% agent purity:	0.92	mg
Average substrate temperature:	36.04	°C
Average air flow rate:	17.17	SLPM
Average air temperature above drop:	35.51	°C
CCVs within criteria:	Yes	
Mass % recovery by extraction:	0.3	%
Total agent % mass recovery:	3.5	%
Mass % recovery in vapor:	3.2	%
Tube #s consistant:	Yes	
Comments:	n/a	

Raw Evaporation rate: 0.034 µg/min

Time (min)	Conc. mg/m³	Agent rem. (%)
18.43	1.89E-03	99.97%
71.80	2.57E-03	99.74%
125.18	2.36E-03	99.50%
178.57	2.22E-03	99.27%
231.95	1.81E-03	99.07%
285.31	1.52E-03	98.90%
338.70	1.43E-03	98.76%
392.08	1.32E-03	98.62%
445.45	7.19E-04	98.52%
498.83	9.37E-04	98.44%
552.21	1.64E-03	98.31%
605.60	1.13E-03	98.17%
658.97	2.78E-04	98.10%
712.35	7.78E-04	98.05%
765.73	6.08E-04	97.98%
819.11	6.16E-04	97.92%
880.83	5.94E-04	97.85%
950.87	5.69E-04	97.77%
1034.25	4.63E-04	97.69%
1117.63	4.13E-04	97.62%
1234.35	4.54E-04	97.53%
1409.38	3.88E-04	97.39%
1589.43	3.43E-04	97.27%
1769.48	2.42E-04	97.17%
1996.18	1.75E-04	97.08%
2222.90	1.71E-04	97.01%
2532.95	2.21E-04	96.89%
2843.00	2.94E-05	96.82%
3349.70	3.88E-05	96.79%
3886.42	1.64E-05	96.76%

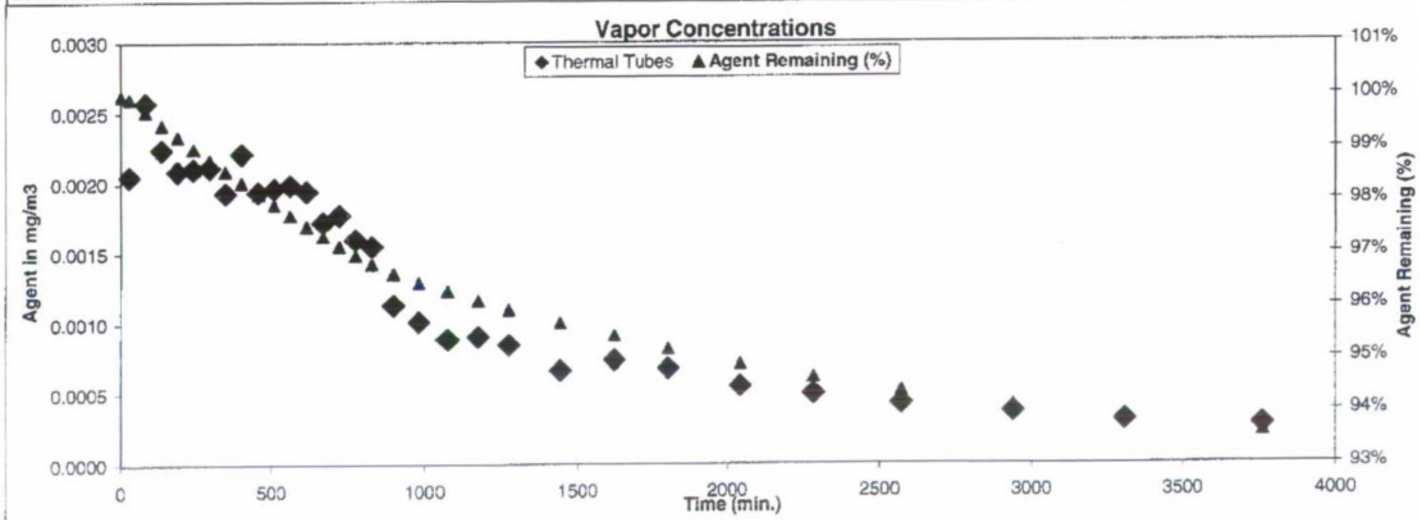


20. Copy of 20070309_3c_200.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD#1	
Date/Experiment #:	03/09/07	200
Type of substrate :	C0.45-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1	µL
Mass of agent disseminated:	1.01	mg
Corrected mass on 100% agent purity:	0.92	mg
Average substrate temperature:	34.44	°C
Average air flow rate:	18.03	SLPM
Average air temperature above drop:	34.85	°C
CCVs within criteria:	Yes	
Mass % recovery by extraction:	n/a	%
Mass % recovery in vapor:	6.4	%
Total agent % mass recovery:	6.4	%
Tube #s consistant:	Yes	
Comments:	n/a	

Raw Evaporation rate: 0.038 µg/min



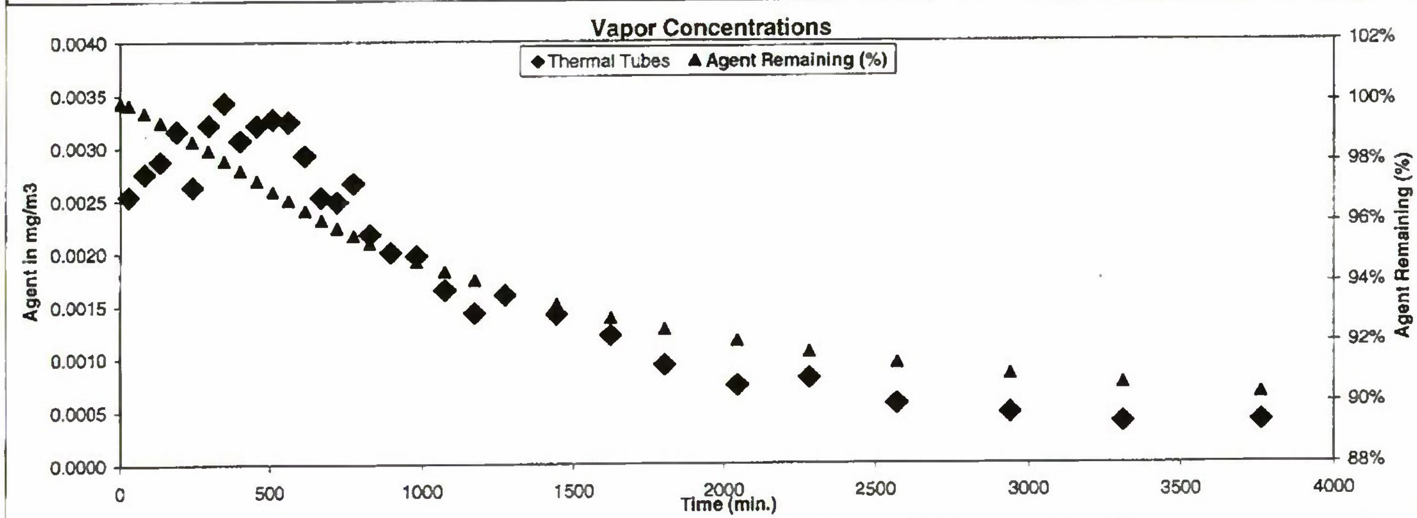
Time (min)	Conc. mg/m^3	Agent rem. (%)
27.95	2.05E-03	99.94%
81.38	2.57E-03	99.70%
134.81	2.24E-03	99.45%
188.23	2.09E-03	99.22%
241.66	2.11E-03	99.00%
295.10	2.12E-03	98.78%
348.53	1.93E-03	98.57%
401.95	2.21E-03	98.35%
455.38	1.94E-03	98.13%
508.81	1.96E-03	97.93%
562.25	1.99E-03	97.72%
615.66	1.94E-03	97.52%
669.10	1.72E-03	97.32%
722.53	1.77E-03	97.14%
775.96	1.60E-03	96.96%
829.40	1.55E-03	96.80%
897.81	1.13E-03	96.62%
981.25	1.01E-03	96.44%
1073.02	8.86E-04	96.27%
1173.12	9.04E-04	96.10%
1273.20	8.46E-04	95.92%
1443.25	6.63E-04	95.67%
1623.30	7.37E-04	95.43%
1803.33	6.76E-04	95.18%
2043.38	5.50E-04	94.89%
2283.43	4.96E-04	94.64%
2570.15	4.29E-04	94.38%
2940.18	3.64E-04	94.09%
3310.23	3.05E-04	93.85%
3763.62	2.72E-04	93.59%

25. Copy of 20070309_3a_163.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	03/09/07 163
Type of substrate :	C0.45-B3-23Feb05-Br
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	35.35 °C
Average air flow rate:	18.08 SLPM
Average air temperature above drop:	35.31 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	9.7 %
Total agent % mass recovery:	9.7 %
Tube #s consistant:	Yes
Comments:	n/a

Raw Evaporation rate: 0.056 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
27.93	2.54E-03	99.93%
81.37	2.76E-03	99.65%
134.80	2.87E-03	99.36%
188.23	3.16E-03	99.04%
241.66	2.63E-03	98.73%
295.10	3.22E-03	98.43%
348.53	3.43E-03	98.08%
401.97	3.07E-03	97.74%
455.38	3.21E-03	97.41%
508.82	3.27E-03	97.07%
562.25	3.25E-03	96.72%
615.68	2.92E-03	96.40%
669.11	2.53E-03	96.11%
722.55	2.49E-03	95.85%
775.98	2.66E-03	95.58%
829.42	2.18E-03	95.32%
897.85	2.00E-03	95.04%
981.28	1.97E-03	94.72%
1073.05	1.65E-03	94.39%
1173.15	1.43E-03	94.09%
1273.23	1.60E-03	93.79%
1443.28	1.41E-03	93.29%
1623.33	1.21E-03	92.82%
1803.38	9.29E-04	92.44%
2043.43	7.33E-04	92.05%
2283.48	8.01E-04	91.69%
2570.20	5.58E-04	91.31%
2940.25	4.72E-04	90.93%
3310.28	3.75E-04	90.62%
3763.67	3.91E-04	90.28%

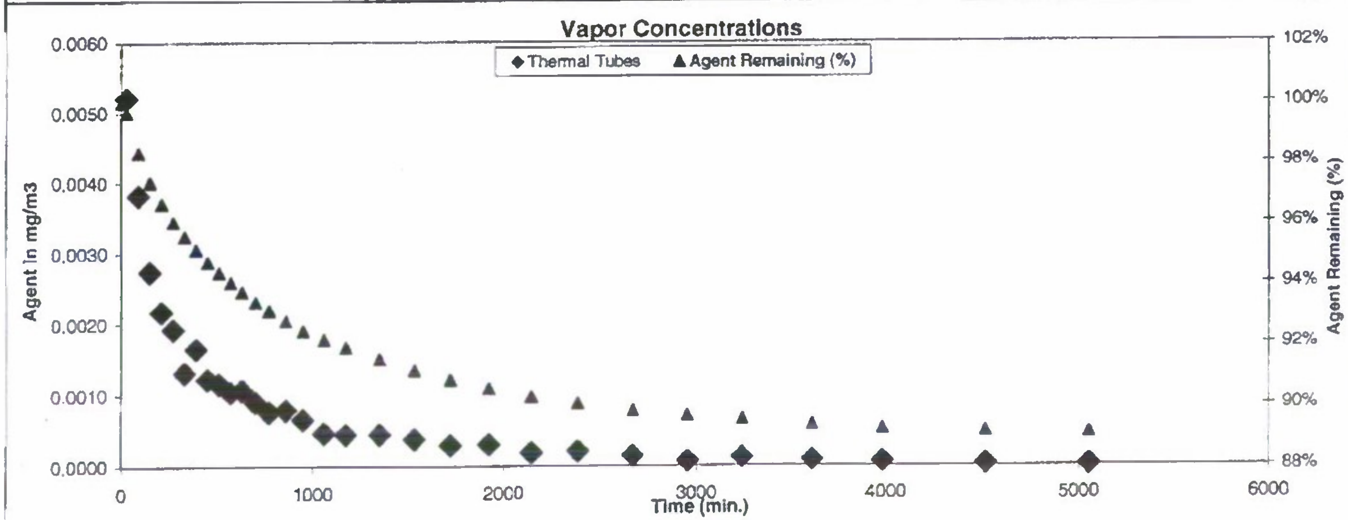
1 Copy of VXC01E3c_LHHL_193_2007-02-01.xls

Data Evaluation Grade: Not For Modeling

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	02/01/07 193
Type of substrate :	Concrete(Cz04)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	35.49 °C
Average air flow rate:	404.94 SLPM
Average air temperature above drop:	35.19 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	5.2 %
Total agent % mass recovery:	16.1 %
Mass % recovery in vapor:	10.9 %
Tube #s consistant:	Yes
Comments:	Video not automatically done. Frame 2 was manually analyzed with Matlab. Measurements for frame 2 are in VideoData sheet. This drop went over the edge of the concrete and should be marked as NFM - tgd

Raw evaporation rate: 1.05 µg/min

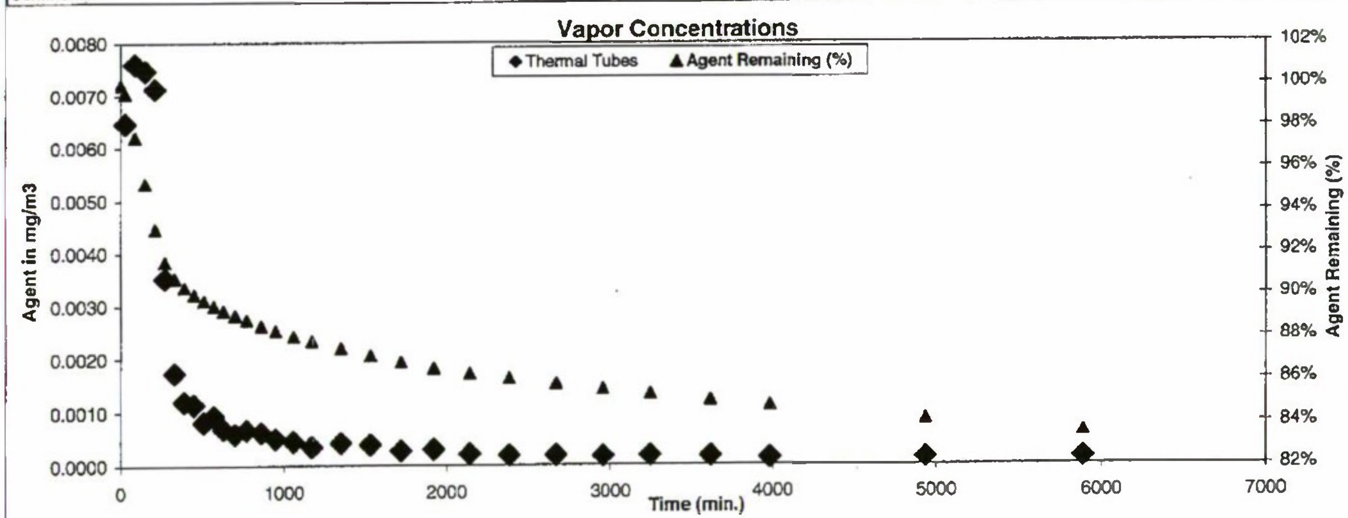
Time (min)	Conc. mg/m³	Agent rem. (%)
26.40	5.21E-03	99.66%
86.45	3.82E-03	98.34%
146.50	2.74E-03	97.37%
206.55	2.17E-03	96.65%
266.58	1.93E-03	96.05%
326.63	1.31E-03	95.57%
386.68	1.65E-03	95.13%
446.72	1.22E-03	94.71%
506.77	1.16E-03	94.36%
566.82	1.04E-03	94.04%
626.87	1.07E-03	93.73%
696.90	9.02E-04	93.39%
766.95	7.62E-04	93.11%
857.00	7.91E-04	92.76%
947.03	6.51E-04	92.45%
1057.10	4.64E-04	92.15%
1172.13	4.46E-04	91.89%
1352.18	4.45E-04	91.50%
1532.23	3.76E-04	91.14%
1722.28	2.90E-04	90.83%
1922.32	3.00E-04	90.54%
2142.37	1.86E-04	90.27%
2382.42	2.04E-04	90.05%
2669.12	1.40E-04	89.80%
2955.83	6.52E-05	89.66%
3242.55	1.16E-04	89.53%
3612.60	8.04E-05	89.36%
3982.63	5.87E-05	89.23%
4519.35	2.30E-05	89.12%
5056.07	1.10E-05	89.08%



2 Copy of VXC01E3c_LHHL_197_2007-02-15.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	02/15/07	197
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	35.66 °C	
Average air flow rate:	405.06 SLPM	
Average air temperature above drop:	34.97 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	0.8 %	
Total agent % mass recovery:	17.3 %	
Mass % recovery in vapor:	16.5 %	Raw evaporation rate: 2.70 µg/min
Tube #s consistant:	Yes	
Comments:	no measurable video obtained - tgd;	refitted sampling port with 5/16" teflon line

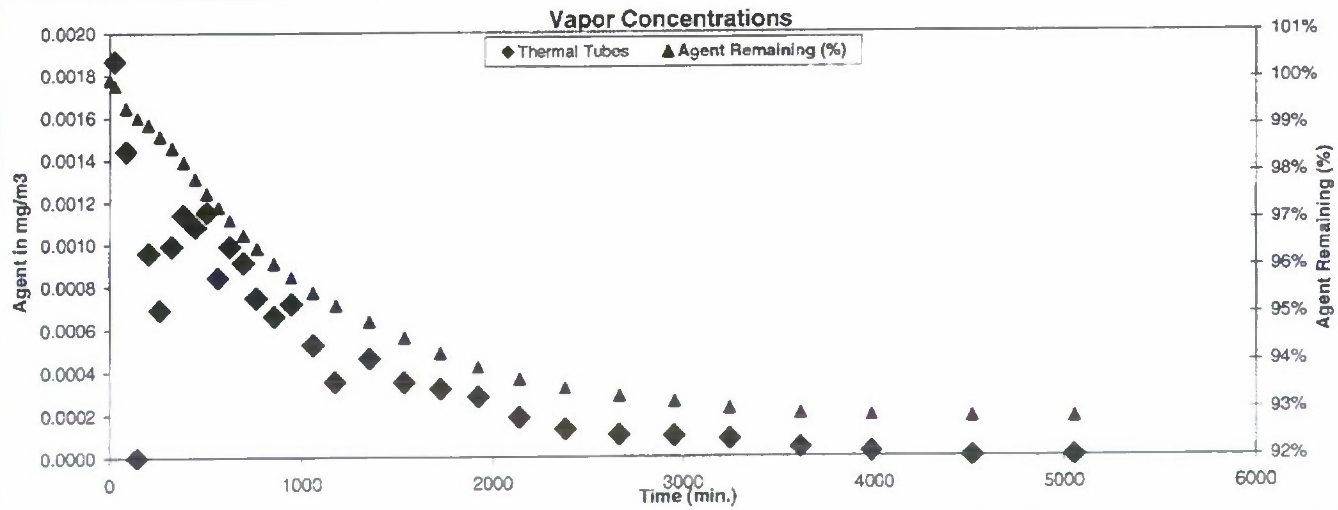


Time (min)	Conc. mg/m³	Agent rem. (%)
26.28	6.46E-03	99.58%
86.33	7.59E-03	97.52%
146.38	7.47E-03	95.30%
206.42	7.13E-03	93.16%
266.47	3.52E-03	91.59%
326.52	1.74E-03	90.82%
386.57	1.20E-03	90.39%
446.60	1.14E-03	90.04%
506.65	8.15E-04	89.76%
566.70	9.26E-04	89.50%
626.73	6.82E-04	89.26%
696.78	5.91E-04	89.04%
766.83	6.64E-04	88.83%
856.88	6.19E-04	88.55%
946.92	5.04E-04	88.30%
1056.97	4.47E-04	88.04%
1172.02	3.47E-04	87.82%
1352.07	4.20E-04	87.48%
1532.12	3.80E-04	87.13%
1722.15	2.67E-04	86.83%
1922.20	2.96E-04	86.55%
2142.25	2.04E-04	86.28%
2382.30	1.81E-04	86.06%
2669.00	1.81E-04	85.80%
2955.72	1.61E-04	85.56%
3242.43	1.72E-04	85.33%
3612.47	1.65E-04	85.02%
3982.52	1.22E-04	84.76%
4935.90	1.33E-04	84.17%
5889.28	1.31E-04	83.55%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	02/01/07 156
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	35.56 °C
Average air flow rate:	405.12 SLPM
Average air temperature above drop:	35.47 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	2.7 %
Total agent % mass recovery:	9.9 %
Mass % recovery in vapor:	7.2 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 0.41 µg/min

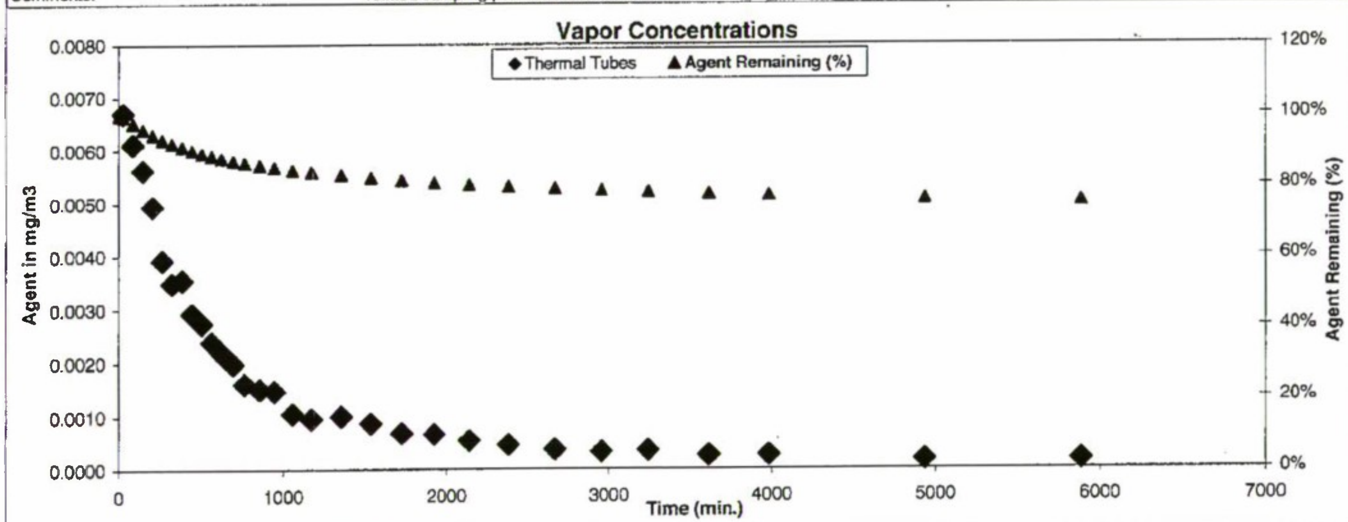


Time (min)	Conc. mg/m^3	Agent rem. (%)
26.22	1.87E-03	99.88%
86.25	1.44E-03	99.39%
146.30	0.00E+00	99.18%
206.35	9.60E-04	99.04%
266.40	6.91E-04	98.80%
326.45	9.90E-04	98.55%
386.50	1.14E-03	98.24%
446.55	1.08E-03	97.91%
506.60	1.15E-03	97.58%
566.63	8.44E-04	97.29%
626.68	9.90E-04	97.02%
696.73	9.15E-04	96.69%
766.78	7.48E-04	96.41%
856.83	6.59E-04	96.10%
946.88	7.19E-04	95.79%
1056.93	5.26E-04	95.46%
1171.98	3.52E-04	95.21%
1352.03	4.63E-04	94.85%
1532.08	3.50E-04	94.49%
1722.13	3.21E-04	94.18%
1922.18	2.82E-04	93.88%
2142.22	1.81E-04	93.63%
2382.27	1.29E-04	93.45%
2668.98	1.02E-04	93.29%
2955.70	9.44E-05	93.15%
3242.42	8.10E-05	93.03%
3612.47	4.08E-05	92.92%
3982.52	2.09E-05	92.86%
4519.23	0.00E+00	92.84%
5055.95	0.00E+00	92.84%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	02/15/07	160
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	34.32 °C	
Average air flow rate:	405.34 SLPM	
Average air temperature above drop:	35.64 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	5.7 %	
Total agent % mass recovery:	30.3 %	
Mass % recovery in vapor:	24.7 %	Raw evaporation rate: 1.60 µg/min
Tube #s consistant:	Yes	
Comments:	refitted sampling port with 5/16" teflon line	

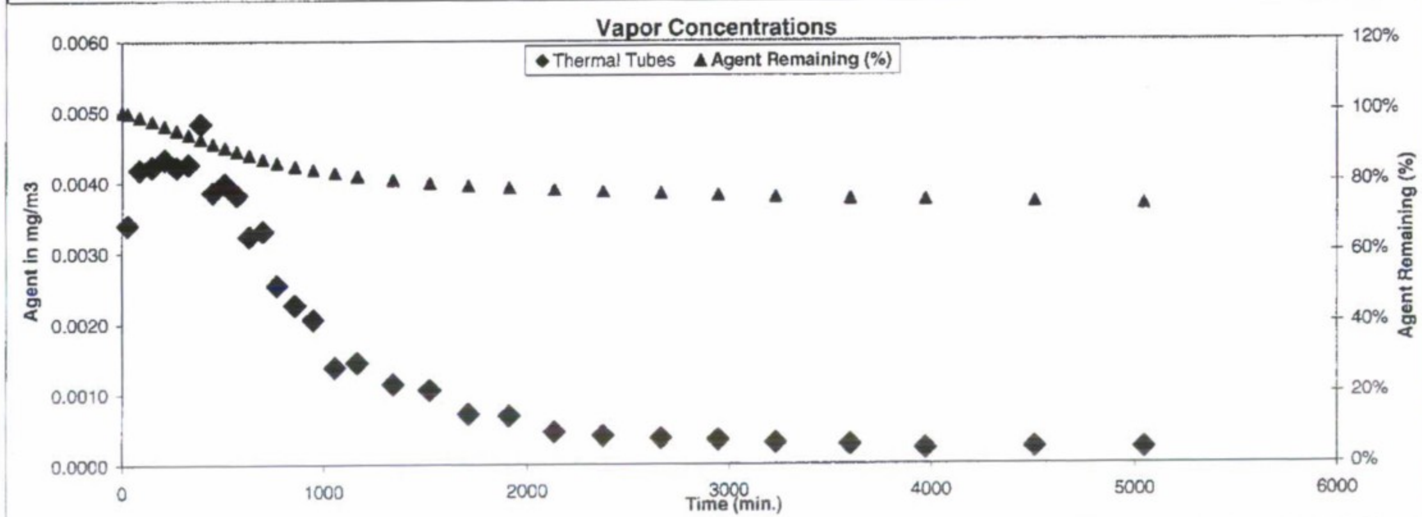
Time (min)	Conc. mg/m^3	Agent rem. (%)
26.20	6.69E-03	99.57%
86.25	6.11E-03	97.69%
146.30	5.62E-03	95.96%
206.35	4.94E-03	94.41%
266.40	3.92E-03	93.10%
326.45	3.49E-03	92.01%
386.48	3.56E-03	90.97%
446.53	2.92E-03	90.02%
506.58	2.74E-03	89.19%
566.63	2.39E-03	88.44%
626.68	2.19E-03	87.76%
696.73	1.98E-03	87.05%
766.78	1.61E-03	86.43%
856.83	1.51E-03	85.75%
946.87	1.47E-03	85.09%
1056.93	1.05E-03	84.41%
1171.98	9.49E-04	83.85%
1352.02	9.95E-04	82.99%
1532.07	8.67E-04	82.17%
1722.12	6.79E-04	81.45%
1922.17	6.59E-04	80.79%
2142.22	5.37E-04	80.15%
2382.27	4.50E-04	79.57%
2668.98	3.67E-04	78.99%
2955.70	3.20E-04	78.51%
3242.42	3.43E-04	78.04%
3612.45	2.53E-04	77.50%
3982.50	2.52E-04	77.05%
4935.88	1.62E-04	76.08%
5889.27	1.64E-04	75.32%



24. Copy of 20070315_3a_165.xls

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	03/15/07	165
Type of substrate :	C0.45-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	36.05 °C	
Average air flow rate:	405.46 SLPM	
Average air temperature above drop:	35.68 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	26.5 %	
Total agent % mass recovery:	26.5 %	Raw evaporation rate: 1.70 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

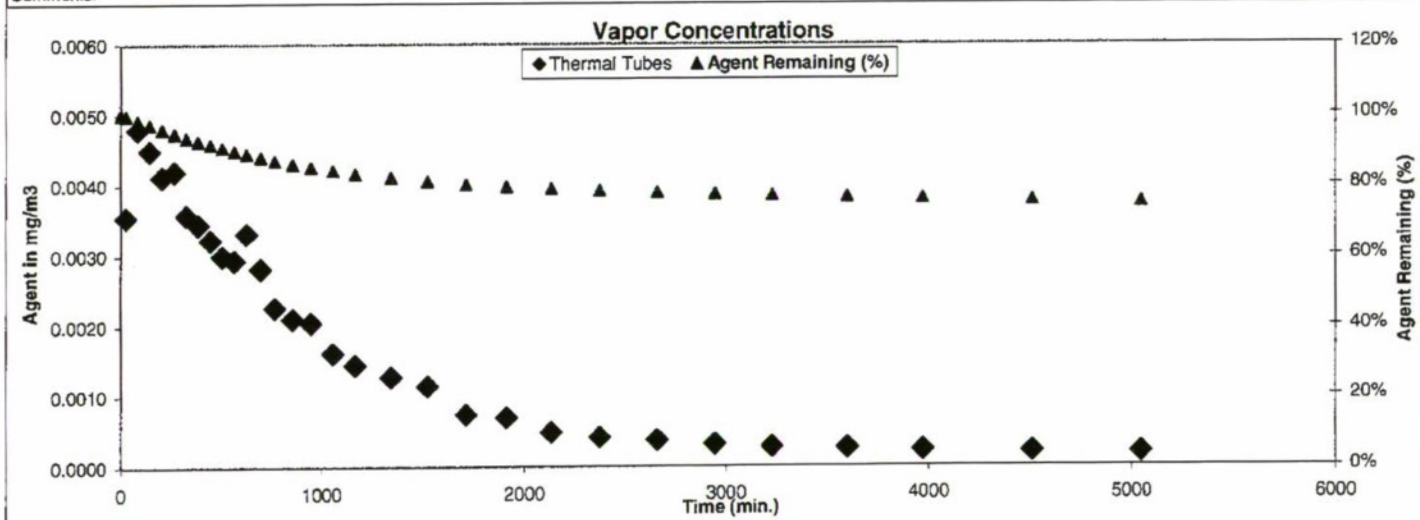


Time (min)	Conc. mg/m^3	Agent rem. (%)
26.15	3.40E-03	99.78%
86.20	4.18E-03	98.87%
146.25	4.22E-03	97.43%
206.30	4.33E-03	96.17%
266.35	4.22E-03	94.91%
326.40	4.26E-03	93.67%
386.45	4.84E-03	92.33%
446.50	3.86E-03	91.05%
506.53	3.99E-03	89.89%
566.58	3.82E-03	88.74%
626.63	3.23E-03	87.71%
696.68	3.31E-03	86.58%
766.73	2.54E-03	85.58%
856.78	2.26E-03	84.52%
946.83	2.06E-03	83.56%
1056.88	1.38E-03	82.64%
1166.93	1.44E-03	81.88%
1341.98	1.14E-03	80.77%
1522.03	1.05E-03	79.80%
1712.08	7.18E-04	78.98%
1912.12	6.90E-04	78.29%
2132.17	4.51E-04	77.67%
2372.22	4.00E-04	77.17%
2658.93	3.64E-04	76.63%
2945.65	3.41E-04	76.14%
3232.37	2.96E-04	75.69%
3602.42	2.74E-04	75.17%
3972.47	2.15E-04	74.73%
4509.17	2.33E-04	74.14%
5045.88	2.16E-04	73.55%

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#09/GCMSD#1
Date/Experiment #:	03/15/07 202
Type of substrate :	C0.45-B3-23Feb05-Br
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	34.90 °C
Average air flow rate:	404.90 SLPM
Average air temperature above drop:	35.53 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	25.1 %
Total agent % mass recovery:	25.1 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.60 µg/min



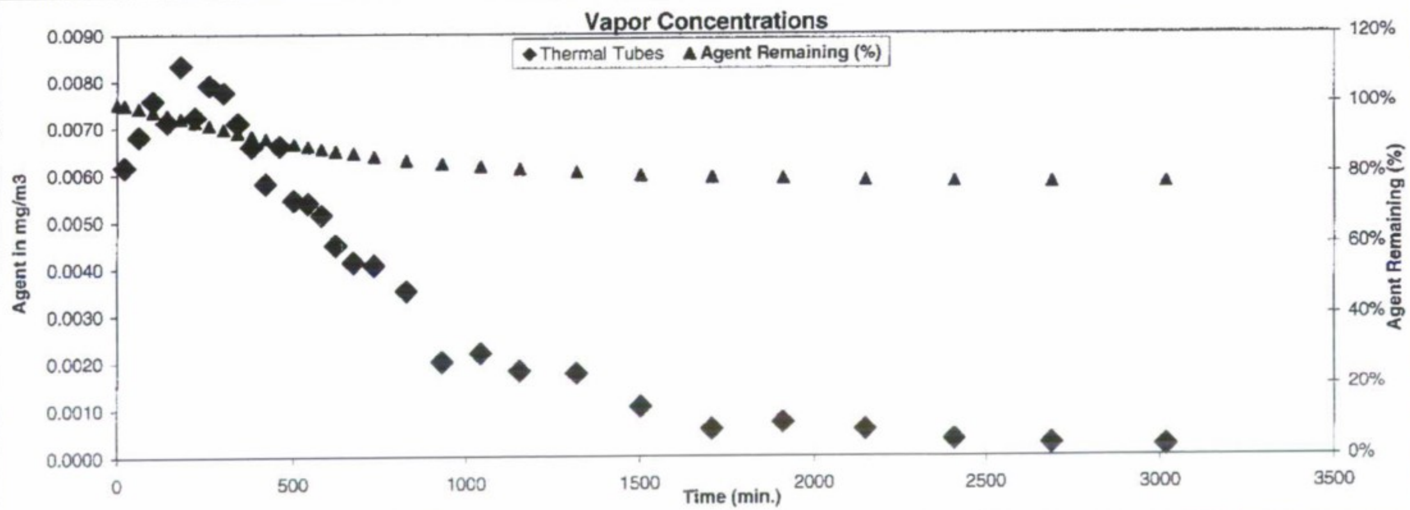
Time (min)	Conc. mg/m^3	Agent rem. (%)
26.22	3.54E-03	99.77%
86.27	4.79E-03	98.55%
146.32	4.49E-03	97.18%
206.37	4.12E-03	95.92%
266.40	4.19E-03	94.70%
326.45	3.58E-03	93.56%
386.50	3.44E-03	92.53%
446.53	3.22E-03	91.55%
506.58	3.00E-03	90.63%
566.63	2.93E-03	89.76%
626.68	3.31E-03	88.84%
696.72	2.81E-03	87.79%
766.77	2.26E-03	86.93%
856.82	2.10E-03	85.96%
946.87	2.05E-03	85.05%
1056.92	1.61E-03	84.06%
1166.97	1.44E-03	83.24%
1342.00	1.27E-03	82.08%
1522.05	1.14E-03	81.02%
1712.10	7.32E-04	80.14%
1912.13	6.95E-04	79.44%
2132.18	4.79E-04	78.81%
2372.23	4.08E-04	78.29%
2658.95	3.66E-04	77.75%
2945.65	3.08E-04	77.28%
3232.37	2.67E-04	76.87%
3602.42	2.54E-04	76.40%
3972.47	2.23E-04	75.97%
4509.17	1.99E-04	75.41%
5045.88	1.91E-04	74.90%

5. Copy of 20070323_3c_204.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#09/GCMSD#2
Date/Experiment #:	03/23/07 204
Type of substrate :	C0.35-B-7Apr05-Br
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	41.66 °C
Average air flow rate:	181.47 SLPM
Average air temperature above drop:	41.83 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	22.8 %
Total agent % mass recovery:	22.8 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.40 µg/min

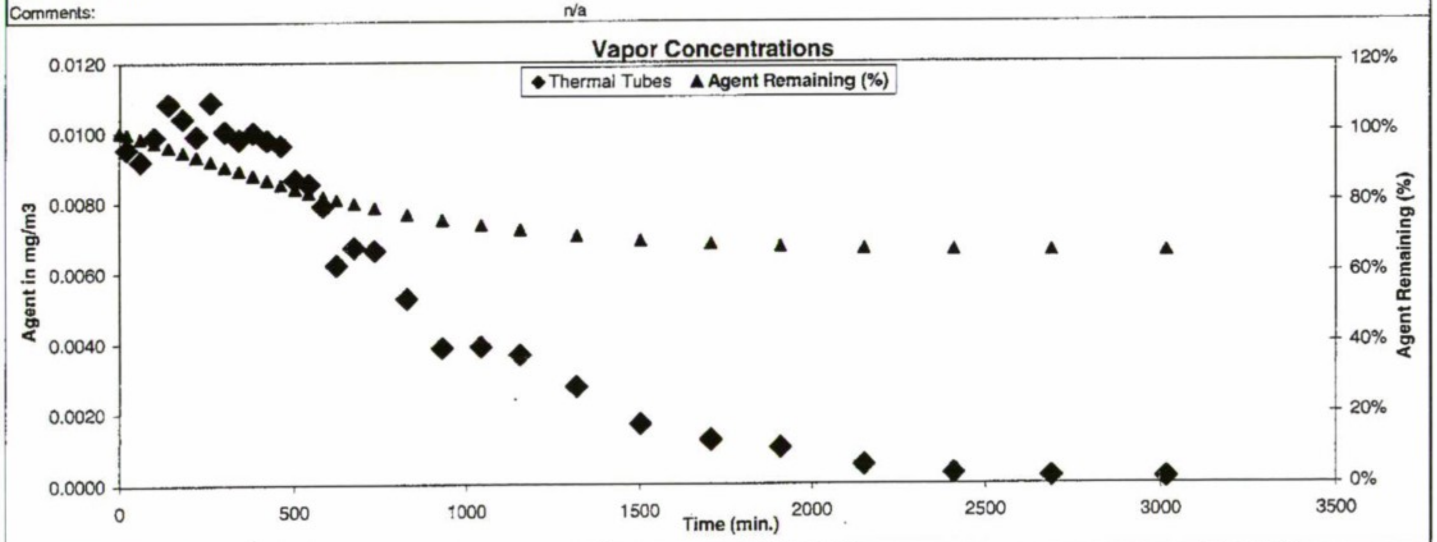


Time (min)	Conc. mg/m^3	Agent rem. (%)
21.17	6.16E-03	99.79%
61.23	6.81E-03	98.93%
101.28	7.57E-03	97.98%
141.35	7.12E-03	97.01%
181.42	8.33E-03	95.99%
221.47	7.23E-03	94.97%
261.53	7.92E-03	93.97%
301.60	7.76E-03	92.94%
341.67	7.10E-03	91.96%
381.72	6.60E-03	91.06%
421.78	5.80E-03	90.24%
461.85	6.61E-03	89.42%
501.92	5.45E-03	88.63%
541.97	5.38E-03	87.91%
582.03	5.14E-03	87.22%
622.10	4.50E-03	86.58%
672.17	4.14E-03	85.87%
732.23	4.07E-03	85.06%
825.60	3.52E-03	83.89%
928.98	2.01E-03	82.95%
1042.37	2.19E-03	82.17%
1155.75	1.81E-03	81.42%
1319.12	1.76E-03	80.46%
1502.50	1.05E-03	79.61%
1705.88	5.73E-04	79.07%
1909.27	7.11E-04	78.64%
2149.30	5.66E-04	78.14%
2409.35	3.45E-04	77.75%
2689.40	2.59E-04	77.47%
3016.12	2.13E-04	77.21%

4. Copy of 20070323_3a_167.xls

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3a	
Instruments:	VTS#08/GCMSD#1	
Date/Experiment #:	03/23/07	167
Type of substrate :	C0.35-B-7Apr05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	40.88 °C	
Average air flow rate:	181.72 SLPM	
Average air temperature above drop:	41.87 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	34.1 %	
Total agent % mass recovery:	34.1 %	Raw evaporation rate: 1.90 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	



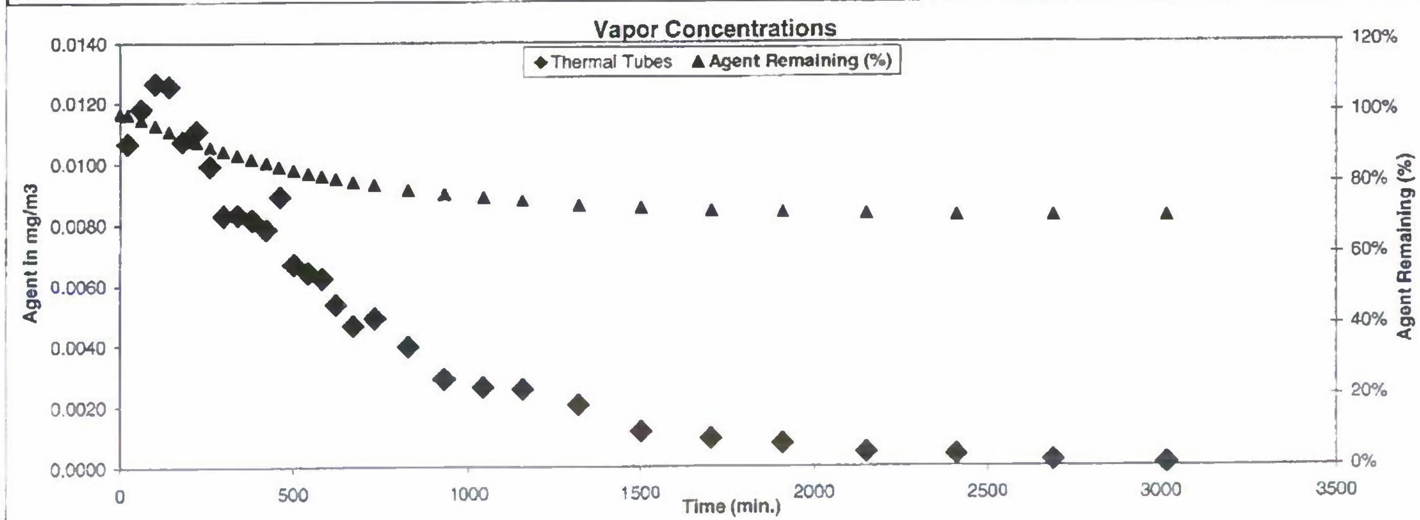
Time (min)	Conc. mg/m³	Agent rem. (%)
21.37	9.52E-03	99.66%
61.43	9.18E-03	98.43%
101.50	9.87E-03	97.17%
141.55	1.08E-02	95.81%
181.62	1.04E-02	94.41%
221.68	9.89E-03	93.07%
261.75	1.09E-02	91.70%
301.82	1.00E-02	90.32%
341.88	9.80E-03	89.01%
381.95	1.00E-02	87.70%
422.02	9.78E-03	86.40%
462.08	9.63E-03	85.11%
502.13	8.64E-03	83.91%
542.20	8.52E-03	82.78%
582.27	7.89E-03	81.69%
622.33	6.22E-03	80.76%
672.40	6.72E-03	79.69%
732.47	6.63E-03	78.37%
825.85	5.26E-03	76.54%
929.23	3.86E-03	74.99%
1042.62	3.89E-03	73.54%
1156.00	3.66E-03	72.13%
1319.38	2.76E-03	70.40%
1502.77	1.70E-03	69.05%
1706.13	1.24E-03	68.07%
1909.52	1.01E-03	67.31%
2149.57	5.28E-04	66.70%
2409.62	2.94E-04	66.35%
2689.67	2.10E-04	66.12%
3016.38	1.65E-04	65.91%

26. Copy of 20070319_3a_166.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#08/GCMSD#1
Date/Experiment #:	03/19/07 166
Type of substrate :	C0.35-B-7Apr05-Br
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	41.68 °C
Average air flow rate:	181.81 SLPM
Average air temperature above drop:	41.85 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	29.6 %
Total agent % mass recovery:	29.6 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 2 µg/min



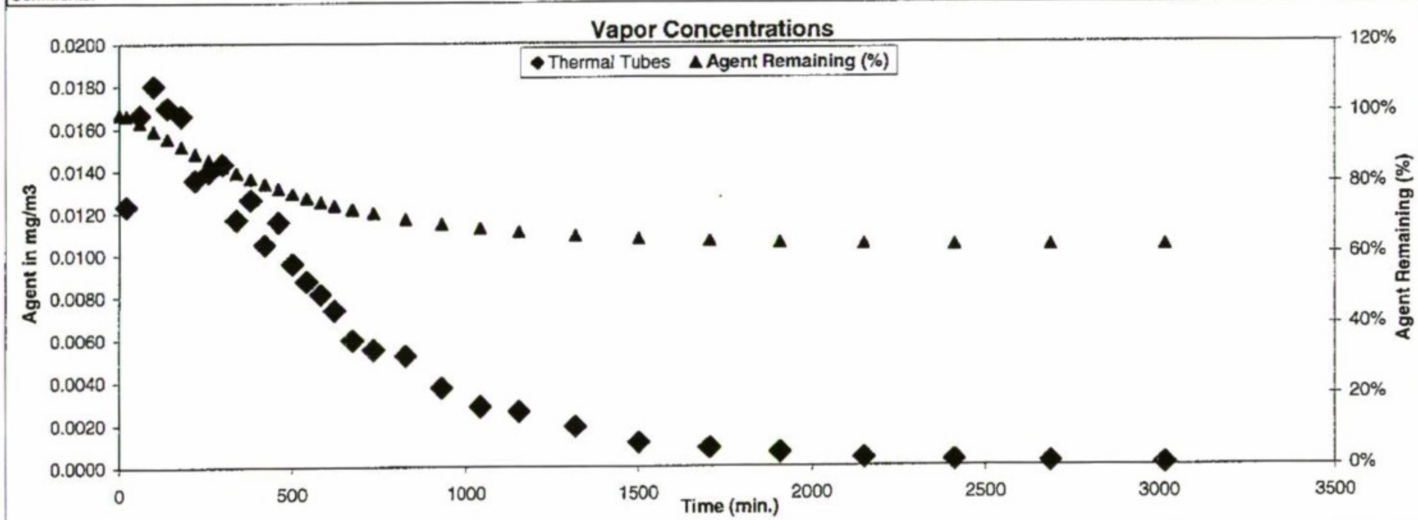
Time (min)	Conc. mg/m^3	Agent rem. (%)
21.67	1.07E-02	99.62%
61.73	1.18E-02	98.13%
101.80	1.27E-02	96.52%
141.87	1.26E-02	94.85%
181.93	1.07E-02	93.31%
222.00	1.11E-02	91.88%
262.07	9.93E-03	90.49%
302.13	8.29E-03	89.28%
342.18	8.31E-03	88.19%
382.25	8.15E-03	87.10%
422.32	7.84E-03	86.04%
462.38	8.92E-03	84.94%
502.45	6.69E-03	83.91%
542.52	6.41E-03	83.04%
582.58	6.22E-03	82.21%
622.65	5.35E-03	81.44%
672.72	4.63E-03	80.62%
732.78	4.89E-03	79.68%
826.17	3.96E-03	78.31%
929.53	2.90E-03	77.15%
1042.92	2.62E-03	76.11%
1156.30	2.56E-03	75.15%
1319.68	2.02E-03	73.91%
1503.07	1.14E-03	72.95%
1706.45	9.35E-04	72.26%
1909.83	7.56E-04	71.69%
2149.88	4.54E-04	71.21%
2409.93	3.78E-04	70.86%
2689.97	1.93E-04	70.59%
3016.68	8.22E-05	70.44%

21. Copy of 20070319_3c_203.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD#1	
Date/Experiment #:	03/19/07	203
Type of substrate :	C0.45-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	41.52	°C
Average air flow rate:	181.52	SLPM
Average air temperature above drop:	41.79	°C
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a	%
Mass % recovery in vapor:	37.8	%
Total agent % mass recovery:	37.8	%
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 2.80 µg/min

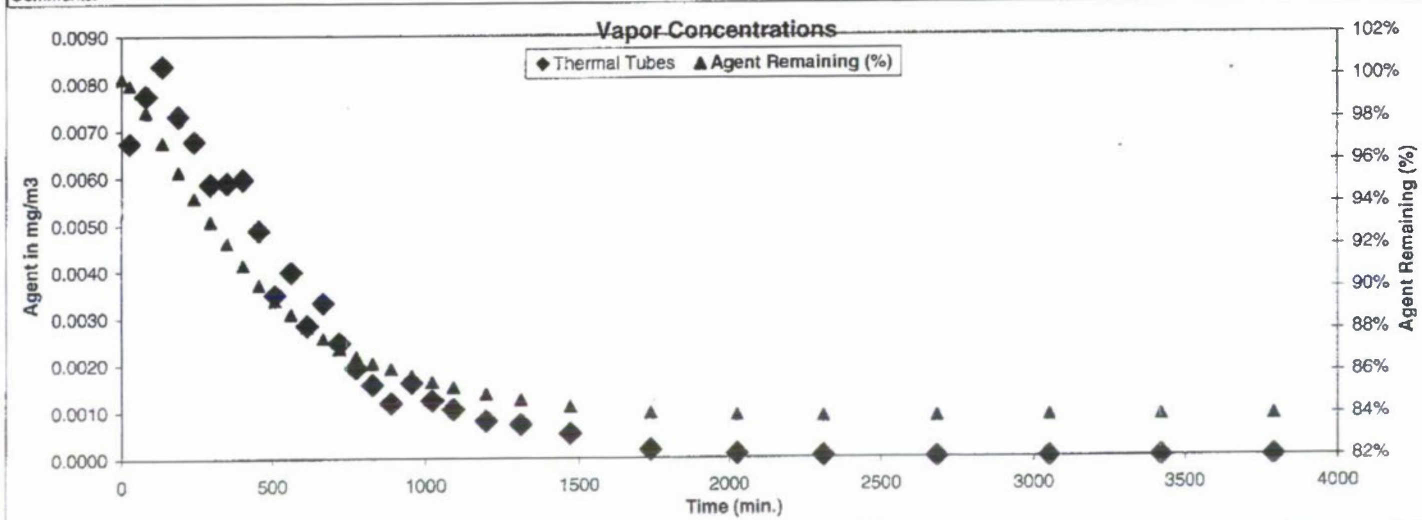


Time (min)	Conc. mg/m^3	Agent rem. (%)
21.10	1.23E-02	99.57%
61.17	1.66E-02	97.66%
101.23	1.80E-02	95.38%
141.30	1.70E-02	93.08%
181.35	1.66E-02	90.87%
221.42	1.36E-02	88.86%
261.48	1.40E-02	87.06%
301.55	1.43E-02	85.20%
341.60	1.17E-02	83.48%
381.67	1.26E-02	81.88%
421.73	1.05E-02	80.35%
461.78	1.16E-02	78.90%
501.85	9.59E-03	77.50%
541.92	8.77E-03	76.29%
581.98	8.14E-03	75.18%
622.05	7.36E-03	74.15%
672.10	5.97E-03	73.06%
732.17	5.52E-03	71.92%
825.55	5.22E-03	70.27%
928.93	3.72E-03	68.75%
1042.30	2.83E-03	67.53%
1155.68	2.60E-03	66.51%
1319.07	1.87E-03	65.31%
1502.45	1.12E-03	64.41%
1705.82	8.54E-04	63.75%
1909.20	6.55E-04	63.24%
2149.25	3.78E-04	62.84%
2409.28	2.57E-04	62.56%
2689.33	1.68E-04	62.37%
3018.05	7.05E-05	62.24%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3L
Instruments:	VTS#10/GCMSD#
Date/Experiment #:	03/09/07 62
Type of substrate :	C0.45-B3-23Feb05-Br
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.14 °C
Average air flow rate:	181.69 SLPM
Average air temperature above drop:	41.06 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	16.1 %
Total agent % mass recovery:	16.1 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.20 µg/min



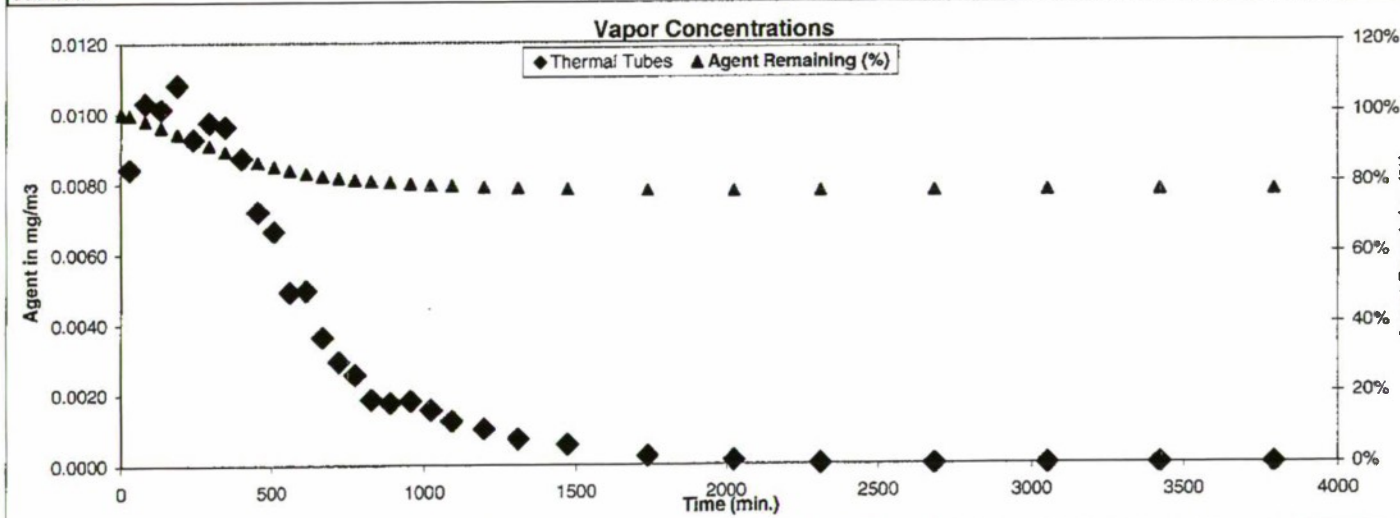
Time (min)	Conc. mg/m^3	Agent rem. (%)
27.06	6.74E-03	99.70%
80.48	7.74E-03	98.43%
133.91	8.37E-03	97.01%
187.35	7.31E-03	95.63%
240.77	6.77E-03	94.39%
294.20	5.87E-03	93.27%
347.63	5.89E-03	92.24%
401.07	5.97E-03	91.20%
454.48	4.88E-03	90.24%
507.92	3.50E-03	89.50%
561.35	3.98E-03	88.85%
614.78	2.85E-03	88.25%
668.20	3.32E-03	87.70%
721.63	2.46E-03	87.19%
775.07	1.93E-03	86.81%
828.50	1.57E-03	86.50%
888.60	1.17E-03	86.23%
955.35	1.61E-03	85.92%
1022.12	1.23E-03	85.61%
1088.89	1.04E-03	85.36%
1195.58	7.97E-04	85.03%
1308.97	7.13E-04	84.75%
1472.35	5.15E-04	84.42%
1739.07	1.64E-04	84.12%
2025.77	7.63E-05	84.01%
2312.48	2.74E-05	83.96%
2682.53	0.00E+00	83.94%
3052.58	0.00E+00	83.94%
3422.62	0.00E+00	83.94%
3792.67	0.00E+00	83.94%

17. Copy of 20070309_3k_063.xls

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3K	
Instruments:	VTS#11/GCMSD#	
Date/Experiment #:	03/09/07	63
Type of substrate :	CZ04 Concrete	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	8 µL	
Mass of agent disseminated:	8.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	41.16 °C	
Average air flow rate:	181.79 SLPM	
Average air temperature above drop:	41.55 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	22.3 %	
Total agent % mass recovery:	22.3 %	
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 1.80 µg/min



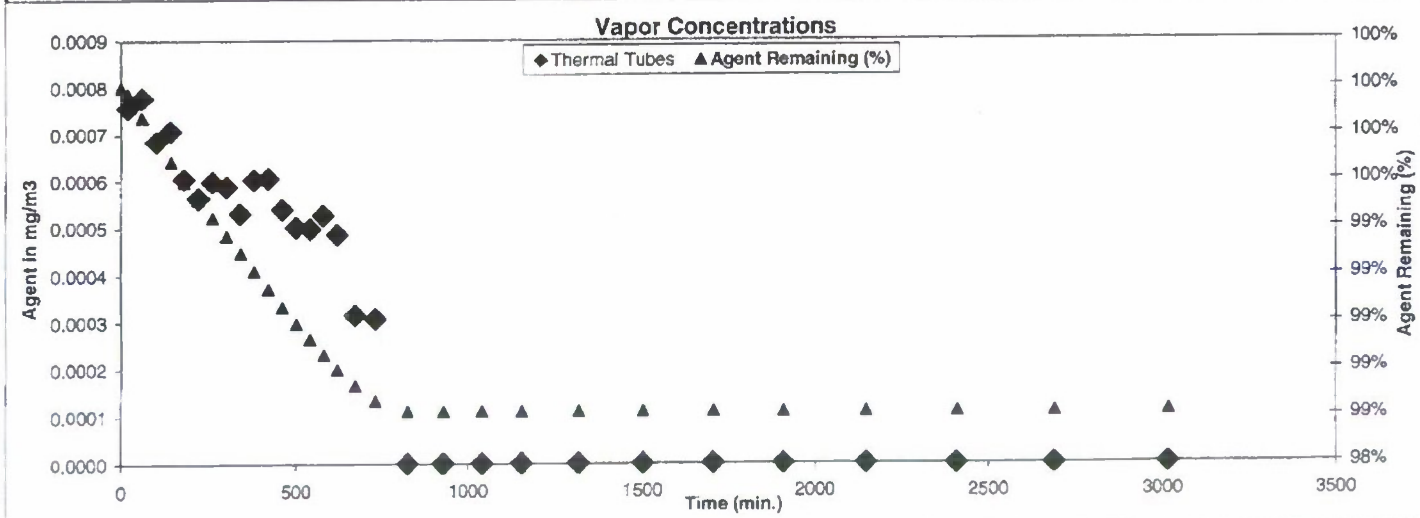
Time (min)	Conc. mg/m^3	Agent rem. (%)
27.05	8.43E-03	99.62%
80.46	1:03E-02	97.97%
133.90	1.01E-02	96.17%
187.33	1.08E-02	94.33%
240.76	9.27E-03	92.56%
294.18	9.75E-03	90.88%
347.61	9.63E-03	89.18%
401.05	8.73E-03	87.56%
454.48	7.21E-03	86.16%
507.90	6.65E-03	84.94%
561.33	4.93E-03	83.92%
614.76	4.97E-03	83.05%
668.18	3.64E-03	82.29%
721.62	2.93E-03	81.71%
775.05	2.57E-03	81.22%
828.48	1.86E-03	80.83%
888.58	1.76E-03	80.48%
955.33	1.81E-03	80.08%
1022.10	1.55E-03	79.71%
1088.87	1.25E-03	79.40%
1195.58	1.02E-03	79.01%
1308.95	7.23E-04	78.68%
1472.33	5.63E-04	78.33%
1739.05	2.34E-04	77.98%
2025.77	1.13E-04	77.82%
2312.47	2.09E-05	77.76%
2682.52	0.00E+00	77.74%
3052.57	0.00E+00	77.74%
3422.60	0.00E+00	77.74%
3792.65	0.00E+00	77.74%

3. Copy of 20070323_3k_068.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3K		
Instruments:	VTS#11/GCMSD#2		
Date/Experiment #:	03/23/07	68	
Type of substrate :	C0.45-B1-23Feb05-Sm		
Test agent:	VX_TCgrade		
Number of drops:	1		
Nominal drop volume:	6	µL	
Mass of agent disseminated:	6.06	mg	
Corrected mass on 100% agent purity:	5.51	mg	
Average substrate temperature:	41.34	°C	
Average air flow rate:	181.75	SLPM	
Average air temperature above drop:	41.89	°C	
CCVs within criteria:	No		
Mass % recovery by extraction:	n/a	%	
Mass % recovery in vapor:	1.4	%	
Total agent % mass recovery:	1.4	%	Raw evaporation rate: 0.11 µg/min
Tube #s consistant:	Yes		
Comments:	n/a		

Time (min)	Conc. mg/m³	Agent rem. (%)
20.42	7.56E-04	99.97%
60.48	7.78E-04	99.87%
100.55	6.86E-04	99.78%
140.62	7.07E-04	99.68%
180.67	6.05E-04	99.60%
220.73	5.63E-04	99.52%
260.80	5.98E-04	99.44%
300.85	5.88E-04	99.37%
340.92	5.30E-04	99.29%
380.98	6.03E-04	99.22%
421.05	6.06E-04	99.14%
461.10	5.39E-04	99.06%
501.17	5.02E-04	98.99%
541.23	4.99E-04	98.93%
581.30	5.26E-04	98.86%
621.37	4.85E-04	98.79%
671.42	3.14E-04	98.73%
731.48	3.07E-04	98.67%
824.87	0.00E+00	98.62%
928.25	0.00E+00	98.62%
1041.62	0.00E+00	98.62%
1155.00	0.00E+00	98.62%
1318.38	0.00E+00	98.62%
1501.77	0.00E+00	98.62%
1705.13	0.00E+00	98.62%
1908.52	0.00E+00	98.62%
2148.57	0.00E+00	98.62%
2408.60	0.00E+00	98.62%
2688.65	0.00E+00	98.62%
3015.37	0.00E+00	98.62%

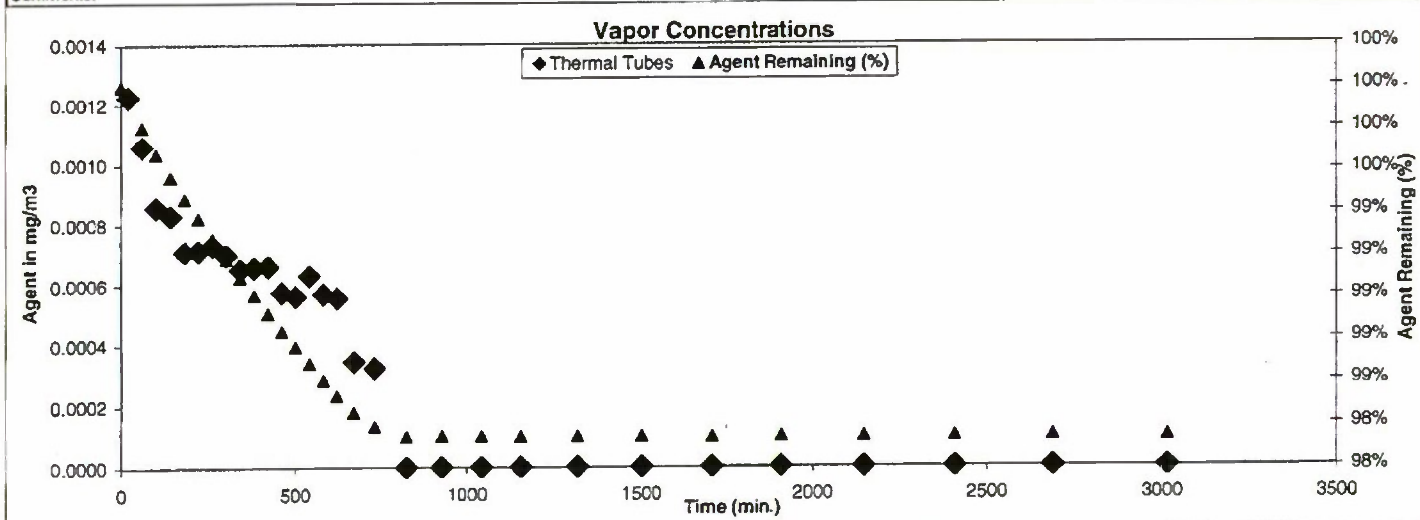


2. Copy of 20070323_3l_067.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L	
Instruments:	VTS#10/GCMSD#2	
Date/Experiment #:	03/23/07	67
Type of substrate :	C0.45-B1-23Feb05-Sm	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	41.88	°C
Average air flow rate:	181.71	SLPM
Average air temperature above drop:	41.72	°C
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a	%
Mass % recovery in vapor:	1.7	%
Total agent % mass recovery:	1.7	%
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.13 µg/min



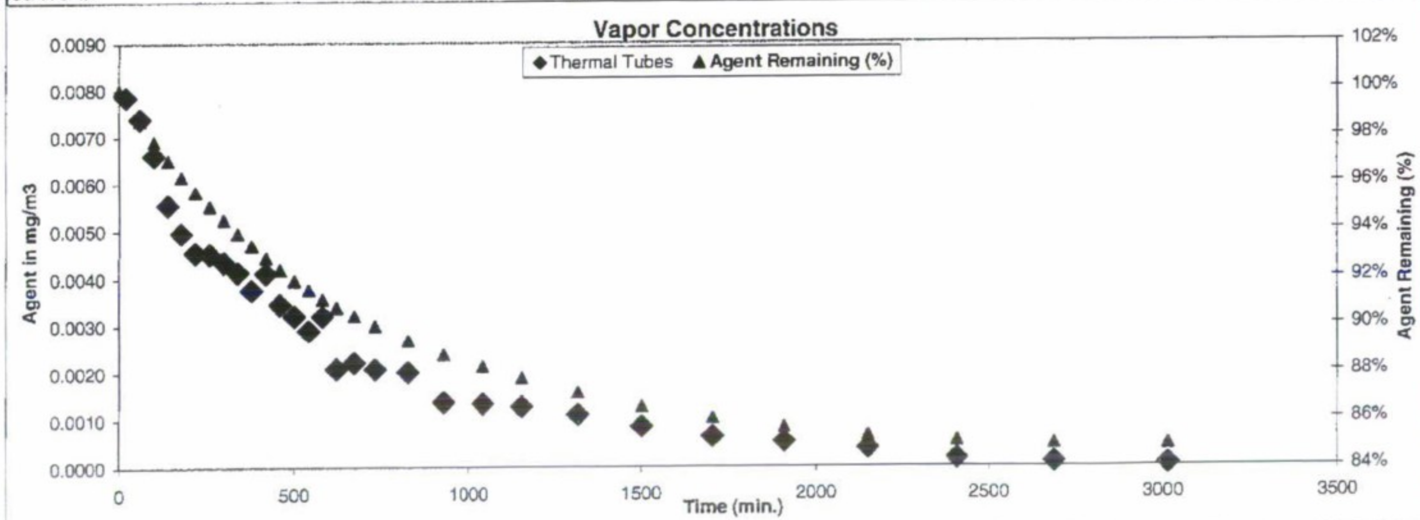
Time (min)	Conc. mg/m³	Agent rem. (%)
20.53	1.23E-03	99.96%
60.58	1.06E-03	99.81%
100.65	8.58E-04	99.68%
140.72	8.32E-04	99.57%
180.78	7.11E-04	99.47%
220.83	7.14E-04	99.37%
260.90	7.32E-04	99.28%
300.97	7.00E-04	99.18%
341.03	6.53E-04	99.09%
381.08	6.57E-04	99.01%
421.15	6.62E-04	98.92%
461.22	5.75E-04	98.84%
501.27	5.62E-04	98.76%
541.33	6.31E-04	98.69%
581.40	5.70E-04	98.61%
621.47	5.56E-04	98.53%
671.53	3.45E-04	98.46%
731.58	3.24E-04	98.39%
824.97	0.00E+00	98.34%
928.35	0.00E+00	98.34%
1041.73	0.00E+00	98.34%
1155.10	0.00E+00	98.34%
1318.48	0.00E+00	98.34%
1501.87	0.00E+00	98.34%
1705.25	0.00E+00	98.34%
1908.62	0.00E+00	98.34%
2148.67	0.00E+00	98.34%
2408.72	0.00E+00	98.34%
2688.75	0.00E+00	98.34%
3015.47	0.00E+00	98.34%

15. Copy of 20070319_3k_067.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3K
Instruments:	VTS#11/GCMSD#1
Date/Experiment #:	03/19/07 67
Type of substrate :	C0.45-B1-23Feb05-Sm
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	40.18 °C
Average air flow rate:	182.38 SLPM
Average air temperature above drop:	41.40 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	15.1 %
Total agent % mass recovery:	15.1 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 0.98 µg/min



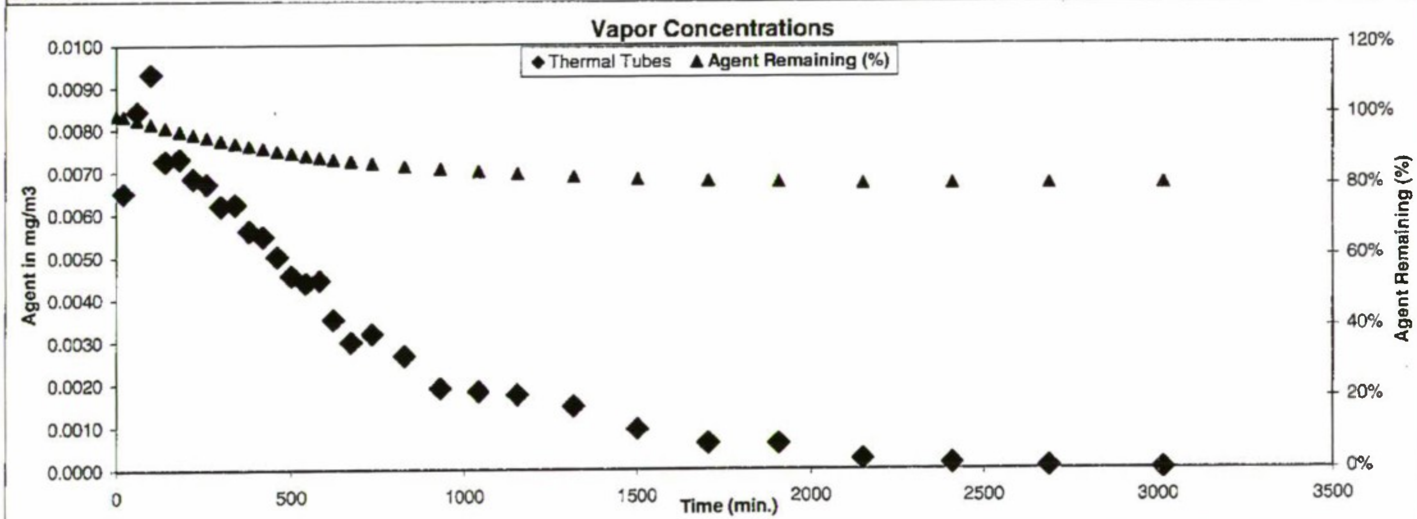
Time (min)	Conc. mg/m^3	Agent rem. (%)
20.37	7.85E-03	99.74%
60.43	7.39E-03	98.73%
100.48	6.60E-03	97.80%
140.55	5.55E-03	96.99%
180.62	4.96E-03	96.30%
220.67	4.55E-03	95.67%
260.73	4.52E-03	95.07%
300.80	4.35E-03	94.48%
340.87	4.13E-03	93.92%
380.92	3.76E-03	93.40%
420.98	4.11E-03	92.87%
461.05	3.46E-03	92.37%
501.12	3.21E-03	91.93%
541.17	2.90E-03	91.53%
581.23	3.20E-03	91.12%
621.30	2.09E-03	90.77%
671.37	2.22E-03	90.41%
731.43	2.08E-03	89.99%
824.80	2.02E-03	89.36%
928.18	1.37E-03	88.78%
1041.57	1.34E-03	88.27%
1154.95	1.27E-03	87.78%
1318.32	1.10E-03	87.14%
1501.70	8.43E-04	86.55%
1705.08	6.31E-04	86.05%
1908.45	5.18E-04	85.66%
2148.50	3.79E-04	85.31%
2408.55	1.59E-04	85.08%
2688.60	8.67E-05	84.96%
3015.30	3.17E-05	84.90%

9. Copy of 20070319_3l_066.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L
Instruments:	VTS#10/GCMSD#1
Date/Experiment #:	03/19/07 66
Type of substrate :	C0.45-B1-23Feb05-Sm
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	41.94 °C
Average air flow rate:	182.17 SLPM
Average air temperature above drop:	41.71 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	19.8 %
Total agent % mass recovery:	19.8 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.30 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
20.45	6.51E-03	99.78%
60.50	8.43E-03	98.79%
100.57	9.31E-03	97.62%
140.63	7.26E-03	96.52%
180.70	7.31E-03	95.56%
220.75	6.85E-03	94.62%
260.82	6.71E-03	93.72%
300.88	6.19E-03	92.87%
340.95	6.23E-03	92.05%
381.00	5.62E-03	91.26%
421.07	5.48E-03	90.53%
461.13	5.00E-03	89.84%
501.18	4.56E-03	89.20%
541.25	4.39E-03	88.61%
581.32	4.45E-03	88.03%
621.38	3.53E-03	87.50%
671.45	2.99E-03	86.96%
731.50	3.18E-03	86.35%
824.88	2.67E-03	85.45%
928.27	1.90E-03	84.67%
1041.65	1.82E-03	83.97%
1155.02	1.75E-03	83.30%
1318.40	1.47E-03	82.44%
1501.78	9.33E-04	81.71%
1705.17	6.00E-04	81.19%
1908.53	5.87E-04	80.79%
2148.58	2.37E-04	80.47%
2408.63	1.28E-04	80.31%
2688.68	4.34E-05	80.23%
3015.38	0.00E+00	80.21%

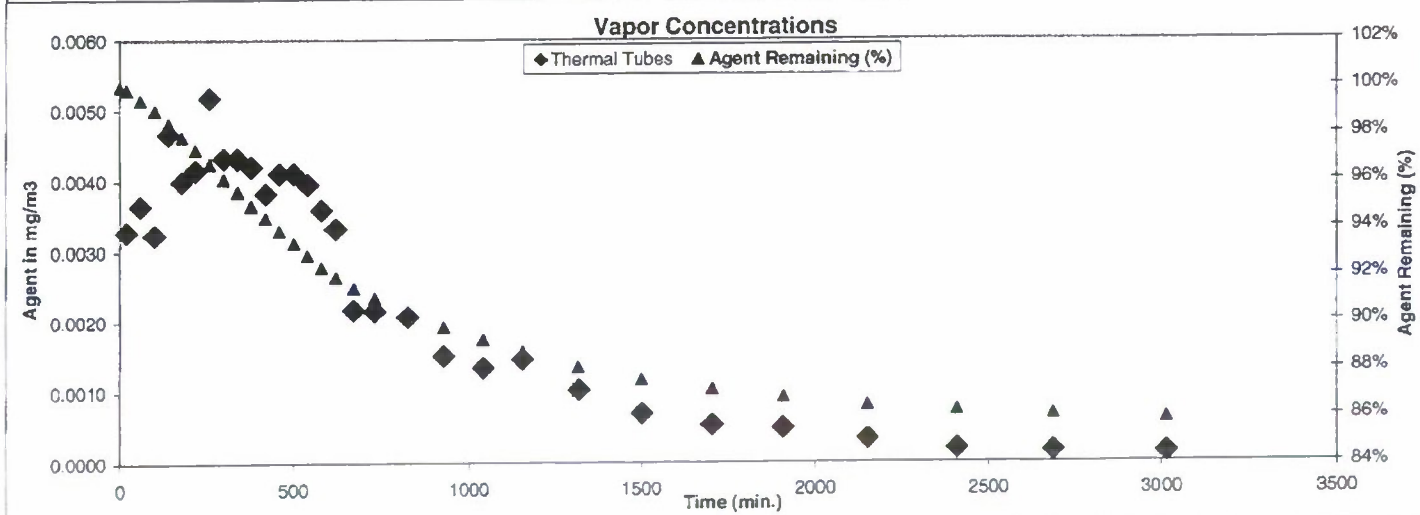
7. Copy of 20070402_3l_070.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L	
Instruments:	VTS#10/GCMSD#	
Date/Experiment #:	04/02/07	70
Type of substrate :	C0.5-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	41.94 °C	
Average air flow rate:	181.72 SLPM	
Average air temperature above drop:	41.73 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	14.1 %	
Total agent % mass recovery:	14.1 %	
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.77 µg/min

Time (min)	Conc. mg/m^3	Agent rem. (%)
20.37	3.28E-03	99.89%
60.43	3.64E-03	99.43%
100.50	3.24E-03	98.98%
140.55	4.66E-03	98.46%
180.62	3.99E-03	97.89%
220.68	4.15E-03	97.35%
260.75	5.17E-03	96.73%
300.80	4.32E-03	96.11%
340.87	4.32E-03	95.54%
380.93	4.20E-03	94.97%
420.98	3.82E-03	94.44%
461.05	4.11E-03	93.92%
501.12	4.10E-03	93.38%
541.18	3.95E-03	92.85%
581.23	3.59E-03	92.35%
621.30	3.32E-03	91.89%
671.37	2.16E-03	91.44%
731.43	2.15E-03	91.01%
824.82	2.07E-03	90.36%
928.18	1.51E-03	89.76%
1041.57	1.34E-03	89.22%
1154.95	1.46E-03	88.70%
1318.33	1.03E-03	88.03%
1501.70	6.90E-04	87.51%
1705.08	5.27E-04	87.10%
1908.47	4.79E-04	86.77%
2148.50	3.24E-04	86.45%
2408.55	1.91E-04	86.23%
2688.60	1.61E-04	86.07%
3015.32	1.37E-04	85.91%



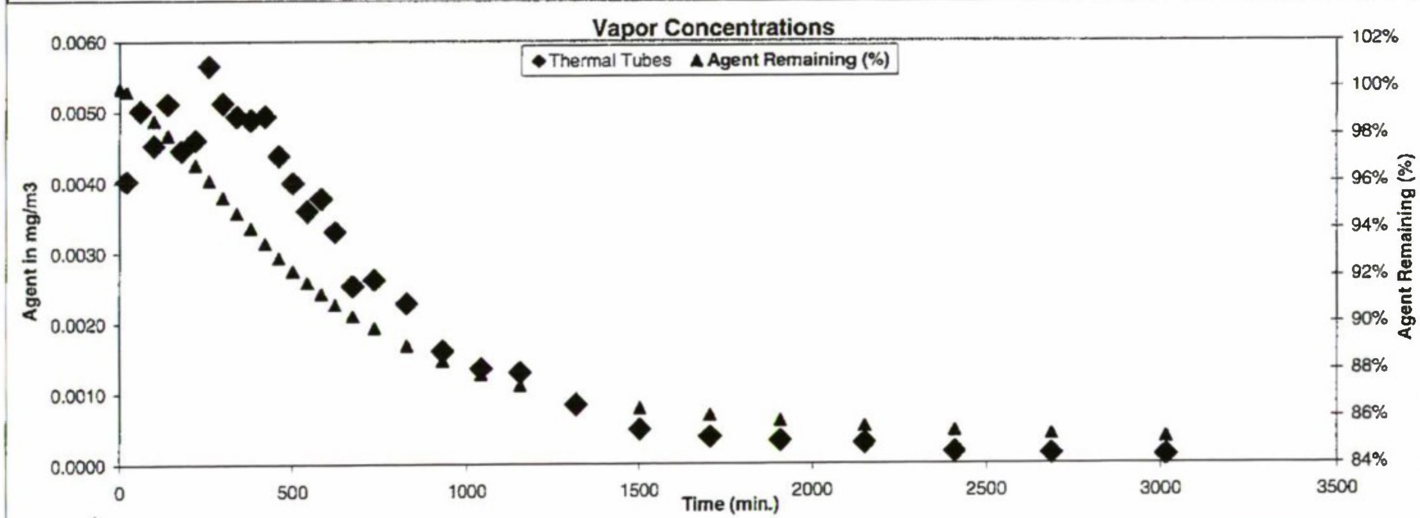
14. Copy of 20070326_3k_069.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3K	
Instruments:	VTS#11/GCMSD#2	
Date/Experiment #:	03/26/07	69
Type of substrate :	C0.5-B1-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	41.80	°C
Average air flow rate:	181.76	SLPM
Average air temperature above drop:	42.01	°C
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a	%
Mass % recovery in vapor:	14.9	%
Total agent % mass recovery:	14.9	%
Tube #s consistant:	Yes	
Comments:	¹ 4 ccvs outside current criteria	

Raw evaporation rate: 0.89 µg/min

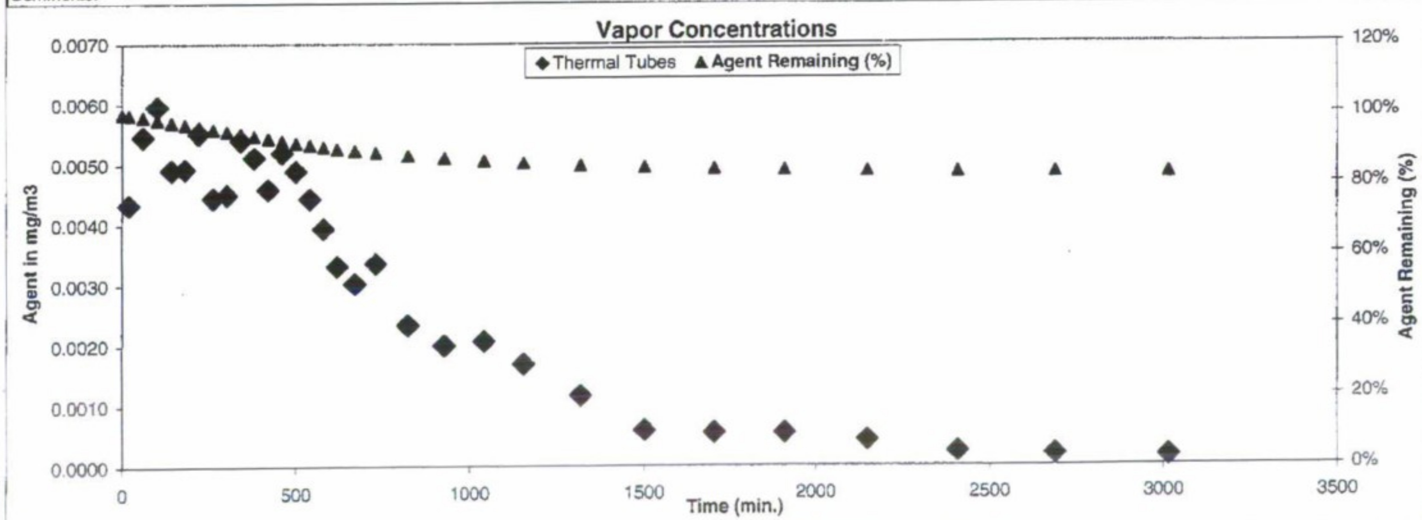
Time (min)	Conc. mg/m³	Agent rem. (%)
20.40	4.03E-03	99.86%
60.45	5.02E-03	99.27%
100.52	4.53E-03	98.64%
140.58	5.12E-03	98.00%
180.63	4.45E-03	97.37%
220.70	4.60E-03	96.77%
260.77	5.65E-03	96.09%
300.83	5.13E-03	95.38%
340.88	4.93E-03	94.72%
380.95	4.88E-03	94.07%
421.02	4.93E-03	93.42%
461.08	4.38E-03	92.81%
501.13	4.00E-03	92.25%
541.20	3.60E-03	91.75%
581.27	3.78E-03	91.26%
621.33	3.31E-03	90.80%
671.40	2.53E-03	90.31%
731.45	2.62E-03	89.80%
824.83	2.28E-03	89.05%
928.22	1.60E-03	88.39%
1041.60	1.36E-03	87.83%
1154.97	1.29E-03	87.34%
1318.35	8.40E-04	86.76%
1501.73	4.85E-04	86.36%
1705.10	3.81E-04	86.07%
1908.48	3.24E-04	85.84%
2148.53	2.96E-04	85.59%
2408.58	1.64E-04	85.39%
2688.62	1.42E-04	85.25%
3015.33	1.19E-04	85.11%



8. Copy of 20070326_3l_068.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L	
Instruments:	VTS#10/GCMSD#2	
Date/Experiment #:	03/26/07	68
Type of substrate :	C0.5-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.03 °C	
Average air flow rate:	181.67 SLPM	
Average air temperature above drop:	41.76 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	17.1 %	
Total agent % mass recovery:	17.1 %	Raw evaporation rate: 0.92 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

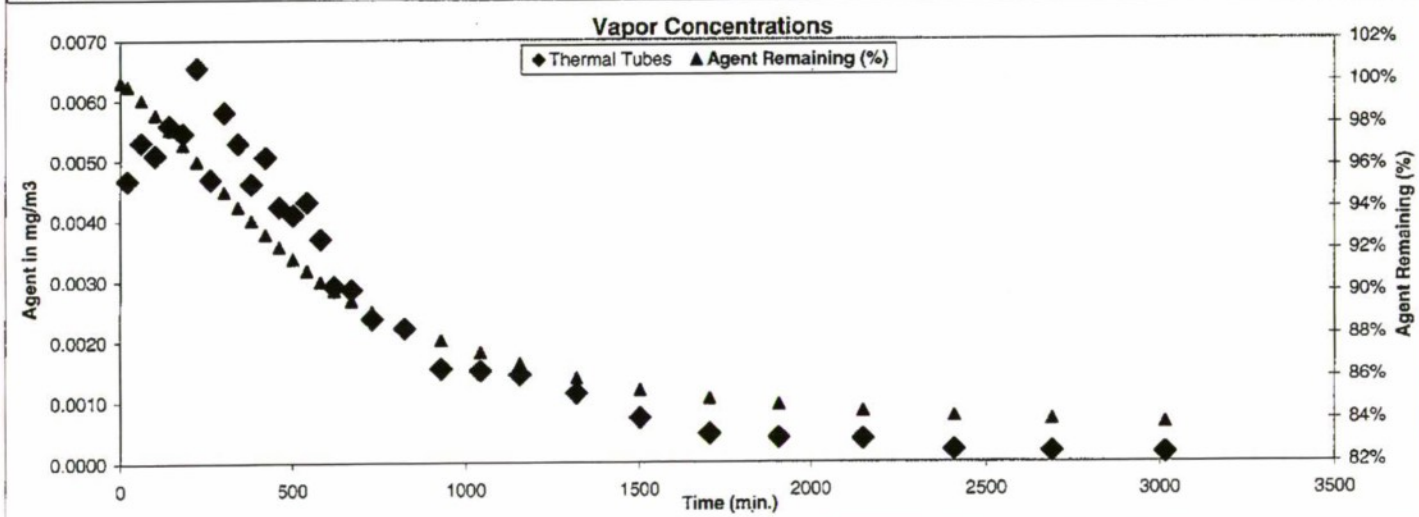


Time (min)	Conc. mg/m^3	Agent rem. (%)
20.43	4.34E-03	99.85%
60.48	5.48E-03	99.21%
100.55	5.96E-03	98.45%
140.62	4.91E-03	97.74%
180.67	4.93E-03	97.09%
220.73	5.52E-03	96.40%
260.80	4.45E-03	95.74%
300.87	4.50E-03	95.15%
340.92	5.41E-03	94.50%
380.98	5.12E-03	93.80%
421.05	4.59E-03	93.16%
461.10	5.19E-03	92.52%
501.17	4.89E-03	91.85%
541.23	4.43E-03	91.23%
581.30	3.94E-03	90.68%
621.37	3.31E-03	90.20%
671.43	3.03E-03	89.68%
731.48	3.36E-03	89.05%
824.87	2.33E-03	88.17%
928.25	2.00E-03	87.44%
1041.62	2.07E-03	86.68%
1155.00	1.68E-03	85.98%
1318.38	1.17E-03	85.21%
1501.77	5.87E-04	84.68%
1705.13	5.52E-04	84.30%
1908.52	5.46E-04	83.93%
2148.57	4.22E-04	83.55%
2408.60	2.26E-04	83.27%
2688.65	1.87E-04	83.08%
3015.37	1.48E-04	82.90%

Data Evaluation Grade: Modeling Grade

Tunnel:	3K	
Instruments:	VTS#11/GCMSD#0	
Date/Experiment #:	04/02/07	71
Type of substrate :	C0.5-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	40.48 °C	
Average air flow rate:	181.78 SLPM	
Average air temperature above drop:	41.69 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	16.2 %	
Total agent % mass recovery:	16.2 %	
Tube #s consistant:	Yes	
Comments:	n/a	

Raw evaporation rate: 1 µg/min

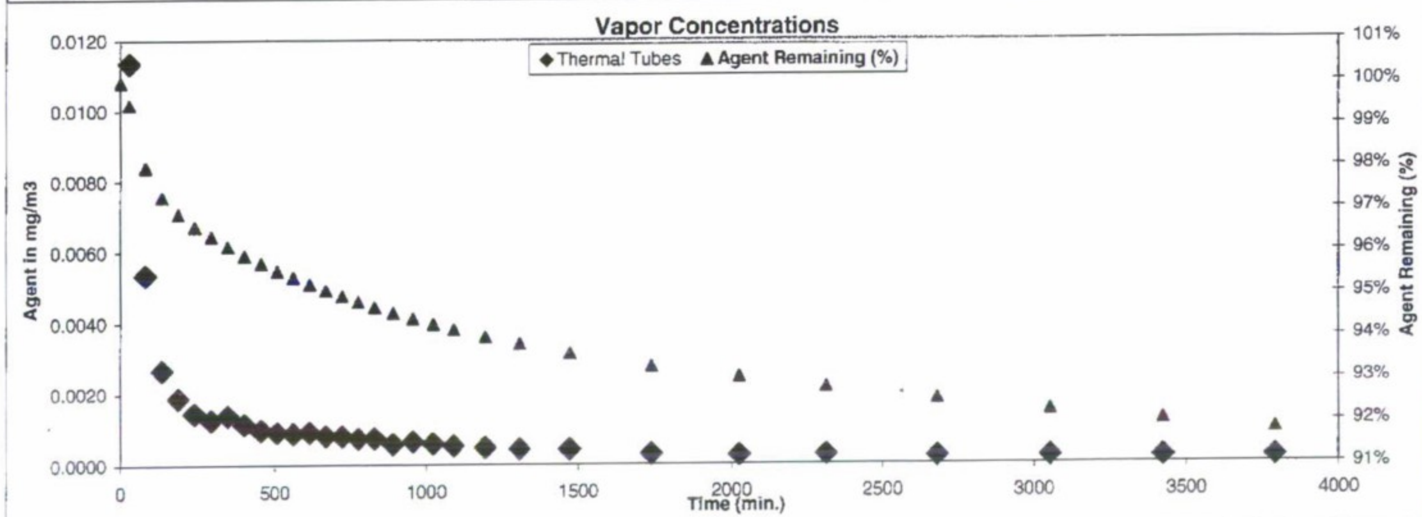


Time (min)	Conc. mg/m^3	Agent rem. (%)
20.35	4.68E-03	99.84%
60.42	5.31E-03	99.18%
100.47	5.10E-03	98.50%
140.53	5.59E-03	97.79%
180.60	5.46E-03	97.06%
220.67	6.54E-03	96.27%
260.72	4.70E-03	95.53%
300.78	5.81E-03	94.83%
340.85	5.29E-03	94.10%
380.92	4.62E-03	93.44%
420.97	5.06E-03	92.80%
461.03	4.24E-03	92.19%
501.10	4.10E-03	91.64%
541.15	4.32E-03	91.08%
581.22	3.70E-03	90.56%
621.28	2.91E-03	90.12%
671.35	2.86E-03	89.64%
731.42	2.38E-03	89.12%
824.78	2.22E-03	88.42%
928.17	1.55E-03	87.77%
1041.55	1.51E-03	87.20%
1154.93	1.44E-03	86.65%
1318.30	1.14E-03	85.96%
1501.68	7.29E-04	85.39%
1705.07	4.65E-04	84.99%
1908.45	3.96E-04	84.70%
2148.48	3.74E-04	84.40%
2408.53	1.97E-04	84.15%
2688.58	1.63E-04	83.99%
3015.28	1.35E-04	83.83%

22. Copy of 20070420_3a_172.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	04/20/07	172
Type of substrate :	CZ04 Concrete	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	41.08 °C	
Average air flow rate:	181.82 SLPM	
Average air temperature above drop:	42.09 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	8.2 %	
Total agent % mass recovery:	8.2 %	Raw evaporation rate: 0.24 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

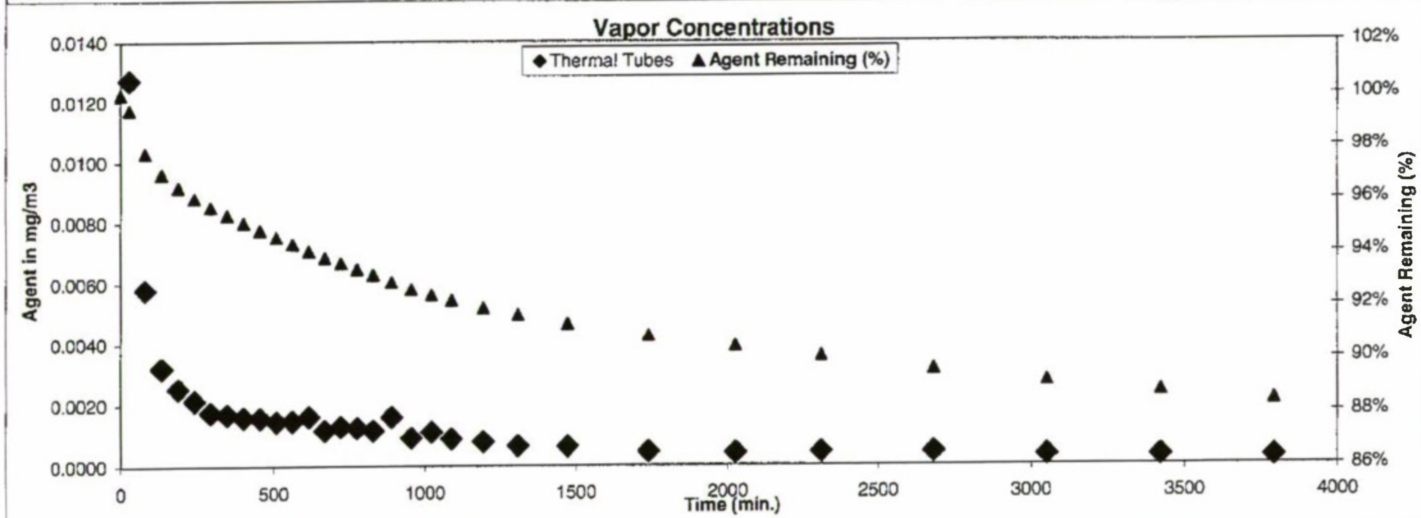


Time (min)	Conc. mg/m^3	Agent rem. (%)
28.07	1.13E-02	99.47%
81.47	5.36E-03	98.00%
134.87	2.67E-03	97.30%
188.27	1.87E-03	96.90%
241.67	1.45E-03	96.61%
295.07	1.26E-03	96.37%
348.45	1.38E-03	96.13%
401.85	1.14E-03	95.91%
455.25	9.72E-04	95.73%
508.65	9.09E-04	95.56%
562.05	8.72E-04	95.40%
615.45	9.09E-04	95.25%
668.85	8.05E-04	95.10%
722.25	8.01E-04	94.96%
775.65	7.30E-04	94.82%
829.05	7.44E-04	94.69%
889.12	5.72E-04	94.56%
955.85	6.39E-04	94.43%
1022.59	5.89E-04	94.29%
1089.30	5.26E-04	94.17%
1196.02	4.76E-04	93.99%
1309.40	4.25E-04	93.82%
1472.78	4.15E-04	93.60%
1739.50	2.80E-04	93.29%
2026.22	2.42E-04	93.05%
2312.93	2.58E-04	92.81%
2682.98	2.11E-04	92.52%
3053.02	2.08E-04	92.27%
3423.07	1.84E-04	92.03%
3793.12	1.79E-04	91.81%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	. 04/09/07 171
Type of substrate :	CZ04 Concrete
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.21 °C
Average air flow rate:	181.64 SLPM
Average air temperature above drop:	42.50 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	11.6 %
Total agent % mass recovery:	11.6 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 0.33 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
28.13	1.27E-02	99.41%
81.53	5.80E-03	97.78%
134.93	3.20E-03	96.99%
188.33	2.53E-03	96.49%
241.73	2.14E-03	96.08%
295.13	1.74E-03	95.74%
348.51	1.68E-03	95.43%
401.92	1.59E-03	95.15%
455.32	1.56E-03	94.87%
508.72	1.45E-03	94.61%
562.12	1.47E-03	94.35%
615.51	1.61E-03	94.08%
668.92	1.15E-03	93.83%
722.32	1.28E-03	93.62%
775.72	1.24E-03	93.40%
829.12	1.16E-03	93.19%
889.18	1.60E-03	92.92%
955.92	9.10E-04	92.64%
1022.65	1.09E-03	92.42%
1089.37	8.76E-04	92.20%
1196.08	7.79E-04	91.91%
1309.47	6.37E-04	91.65%
1472.85	6.19E-04	91.31%
1739.57	4.33E-04	90.85%
2026.28	3.86E-04	90.46%
2313.00	4.17E-04	90.08%
2683.05	4.10E-04	89.58%
3053.10	3.15E-04	89.13%
3423.13	3.01E-04	88.76%
3793.18	2.68E-04	88.41%

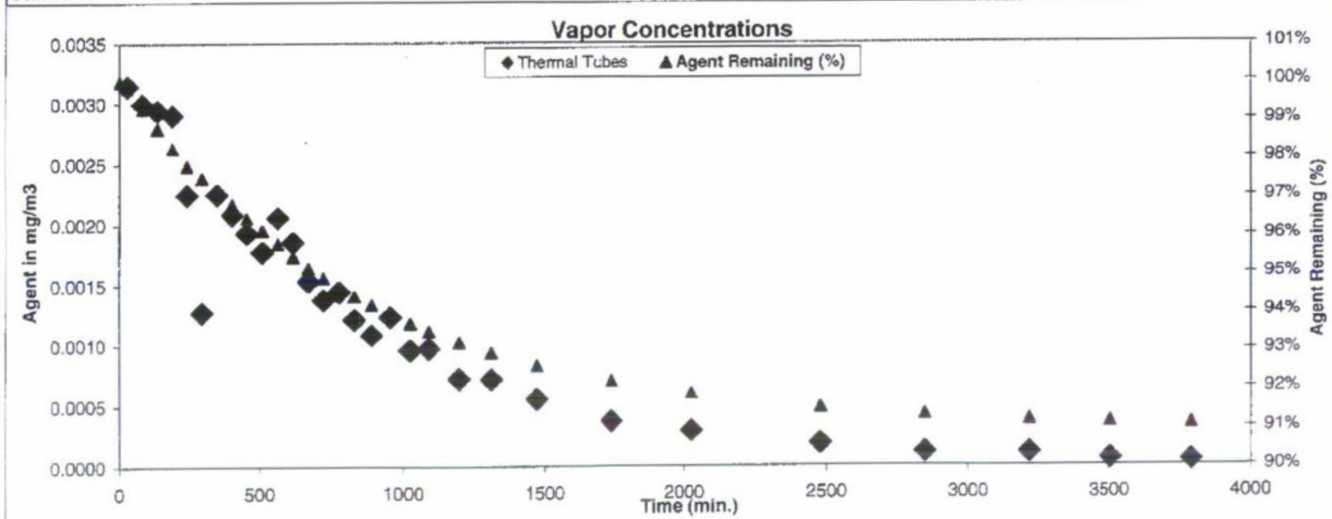
29. Copy of 20070129_3a_155.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	01/29/07	155
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX	
Number of drops:	1	
Nominal drop volume:	6	µL
Mass of agent disseminated:	6.06	mg
Corrected mass on 100% agent purity:	5.51	mg
Average substrate temperature:	41.08	°C
Average air flow rate:	181.77	SLPM
Average air temperature above drop:	41.71	°C
Mass % recovery in vapor:	8.9	%
Mass % recovery by extraction:	0.2	%
Total agent % mass recovery:	9.1	%
Tube #s consistant:	Yes	
Daily CCV < +/- 15%:	Yes	
Comments:	n/a	

Raw evaporation rate: 0.39 µg/min

Time (min)	Conc. mg/m^3	Agent rem. (%)
28.27	3.15E-03	99.85%
81.65	3.00E-03	99.31%
135.03	2.95E-03	98.79%
188.42	2.91E-03	98.28%
241.80	2.25E-03	97.82%
295.17	1.27E-03	97.51%
348.55	2.25E-03	97.20%
401.93	2.09E-03	96.82%
455.32	1.93E-03	96.47%
508.70	1.78E-03	96.14%
562.08	2.06E-03	95.80%
615.47	1.85E-03	95.46%
668.85	1.53E-03	95.16%
722.22	1.37E-03	94.90%
775.60	1.44E-03	94.66%
829.00	1.21E-03	94.42%
889.05	1.08E-03	94.20%
955.75	1.23E-03	93.94%
1022.47	9.54E-04	93.70%
1089.19	9.67E-04	93.49%
1195.90	7.16E-04	93.19%
1309.28	7.10E-04	92.93%
1472.67	5.49E-04	92.59%
1739.38	3.69E-04	92.19%
2026.10	2.90E-04	91.87%
2479.47	1.85E-04	91.52%
2849.52	1.11E-04	91.34%
3219.57	1.07E-04	91.21%
3506.28	5.18E-05	91.13%
3793.00	3.76E-05	91.09%

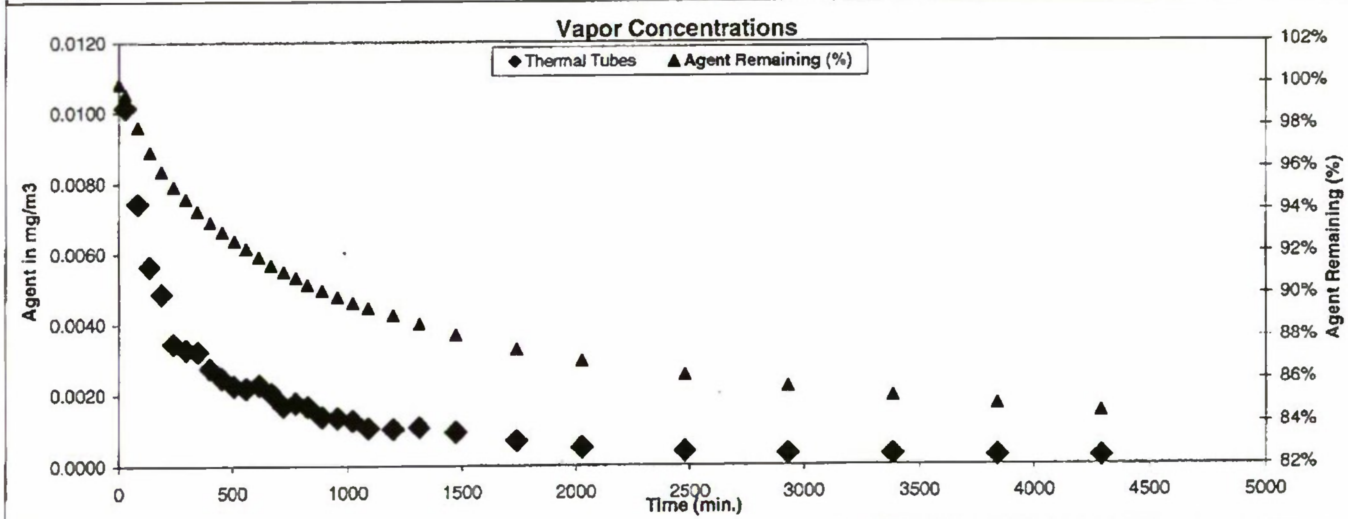


2 Copy of VXC01E3a_MMML_158_2007-02-08.xls

Data Evaluation Grade: **Modeling Grade**

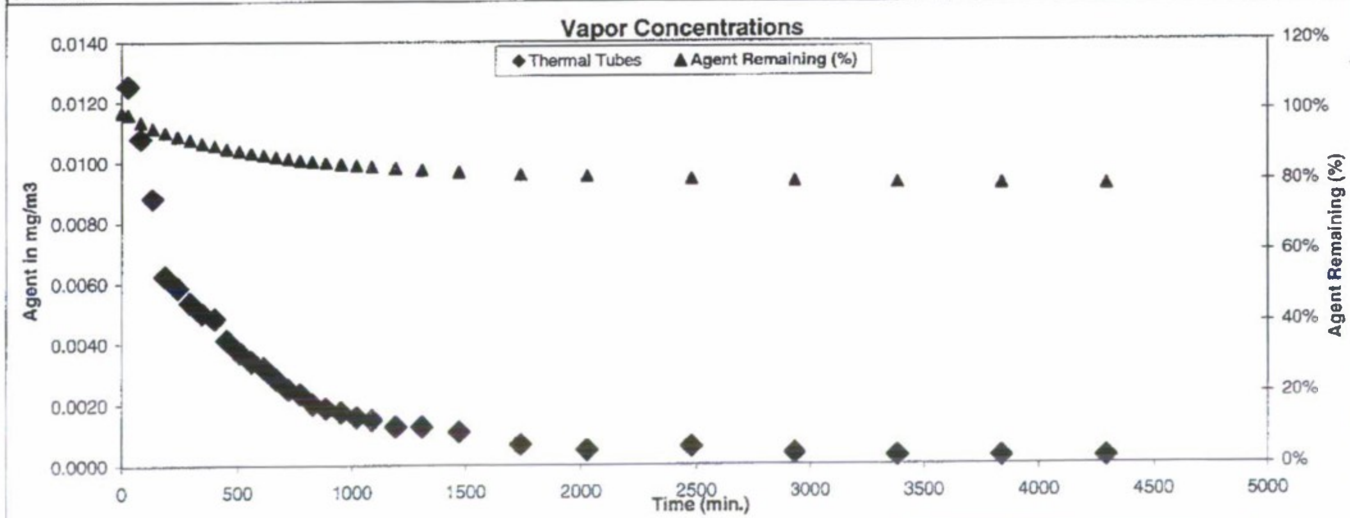
Tunnel:	3a	
Instruments:	VTS#08/GCMSD	
Date/Experiment #:	02/08/07	158
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	41.36 °C	
Average air flow rate:	181.69 SLPM	
Average air temperature above drop:	41.89 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	2.4 %	
Total agent % mass recovery:	17.9 %	
Mass % recovery in vapor:	15.5 %	Raw evaporation rate: 0.96 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

Time (min)	Conc. mg/m³	Agent rem. (%)
28.10	1.01E-02	98.53%
81.48	7.43E-03	97.99%
134.85	5.65E-03	96.84%
188.23	4.86E-03	95.91%
241.61	3.44E-03	95.18%
295.00	3.27E-03	94.59%
348.38	3.22E-03	94.02%
401.76	2.74E-03	93.50%
455.15	2.46E-03	93.04%
508.53	2.24E-03	92.63%
561.92	2.18E-03	92.24%
615.28	2.27E-03	91.85%
668.66	2.03E-03	91.47%
722.05	1.68E-03	91.14%
775.43	1.76E-03	90.84%
828.81	1.66E-03	90.54%
888.87	1.37E-03	90.24%
955.59	1.33E-03	89.94%
1022.30	1.25E-03	89.66%
1089.02	1.03E-03	89.41%
1195.73	1.00E-03	89.05%
1309.12	1.05E-03	88.67%
1472.50	9.14E-04	88.14%
1739.20	6.88E-04	87.43%
2025.92	5.01E-04	86.87%
2479.30	3.88E-04	86.21%
2932.68	3.22E-04	85.68%
3386.07	2.89E-04	85.22%
3839.45	2.42E-04	84.83%
4292.83	2.18E-04	84.48%



Data Evaluation Grade: Modeling Grade

Tunnel:	3c	
Instruments:	VTS#09/GCMSD	
Date/Experiment #:	02/08/07	195
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCGrade	
Number of drops:	1	
Nominal drop volume:	6 µL	
Mass of agent disseminated:	6.06 mg	
Corrected mass on 100% agent purity:	5.51 mg	
Average substrate temperature:	42.34 °C	
Average air flow rate:	181.49 SLPM	
Average air temperature above drop:	42.12 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	2.0 %	
Total agent % mass recovery:	23.1 %	
Mass % recovery in vapor:	21.2 %	Raw evaporation rate: 1.10 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	



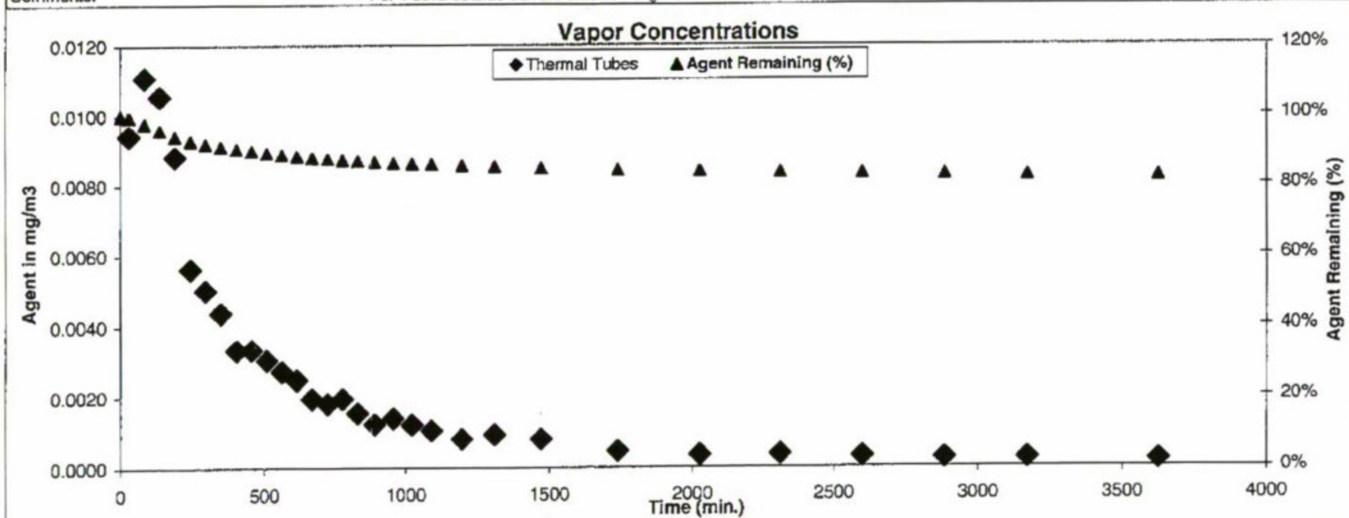
Time (min)	Conc. mg/m³	Agent rem. (%)
27.71	1.26E-02	99.43%
81.10	1.08E-02	97.38%
134.48	8.82E-03	95.65%
187.85	6.24E-03	94.33%
241.23	5.86E-03	93.27%
294.61	5.37E-03	92.28%
348.00	5.01E-03	91.37%
401.36	4.84E-03	90.50%
454.75	4.13E-03	89.71%
508.13	3.73E-03	89.02%
561.50	3.42E-03	88.39%
614.88	3.23E-03	87.81%
668.26	2.86E-03	87.27%
721.65	2.51E-03	86.80%
775.01	2.36E-03	86.38%
828.40	2.03E-03	85.99%
888.45	1.88E-03	85.60%
955.17	1.76E-03	85.20%
1021.88	1.59E-03	84.84%
1088.58	1.50E-03	84.50%
1195.30	1.28E-03	84.01%
1308.68	1.27E-03	83.53%
1472.07	1.10E-03	82.90%
1738.77	6.70E-04	82.12%
2025.48	4.78E-04	81.58%
2478.87	5.83E-04	80.79%
2932.23	3.63E-04	80.08%
3385.62	2.79E-04	79.60%
3839.00	2.52E-04	79.20%
4292.38	2.22E-04	78.85%

1 Copy of VXC01E3a_MMML_157_2007-02-05.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	02/05/07 157
Type of substrate :	Concrete(cz04)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.44 °C
Average air flow rate:	181.51 SLPM
Average air temperature above drop:	41.77 °C
CCVs within criteria:	No
Mass % recovery by extraction:	3.6 %
Total agent % mass recovery:	21.3 %
Mass % recovery in vapor:	17.6 %
Tube #s consistant:	Yes
Comments:	1 of 4 ccvs outside current criteria - cvg

Raw evaporation rate: 1.10 µg/min

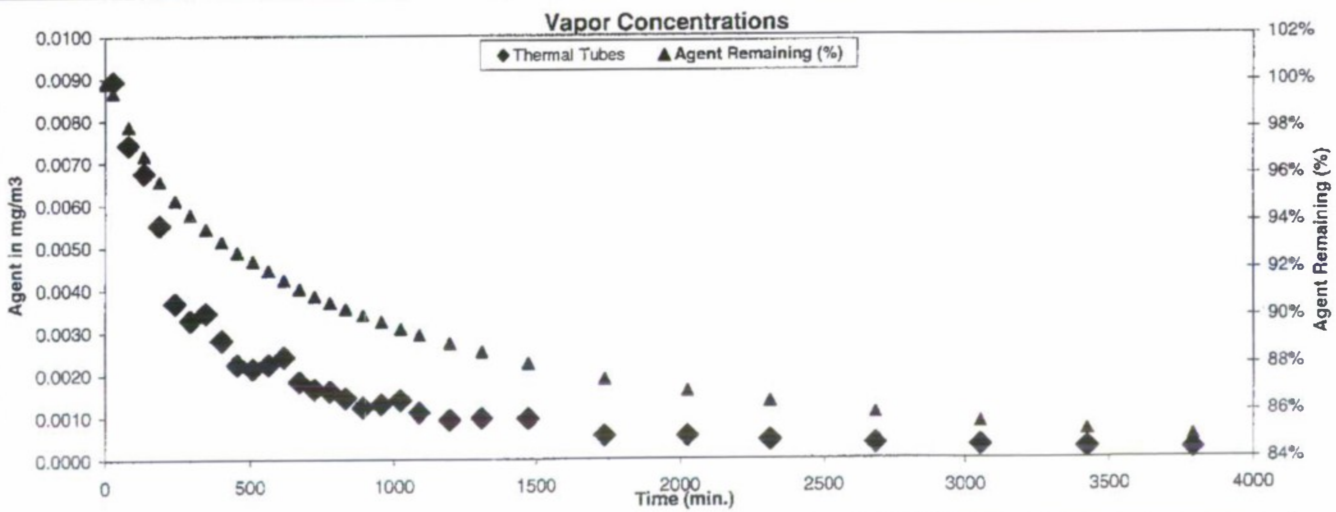


Time (min)	Conc. mg/m³	Agent rem. (%)
28.36	9.42E-03	99.56%
81.73	1.11E-02	97.76%
135.11	1.05E-02	95.86%
188.50	8.83E-03	94.16%
241.88	5.63E-03	92.89%
295.26	5.02E-03	91.95%
348.65	4.37E-03	91.13%
402.03	3.33E-03	90.45%
455.41	3.34E-03	89.87%
508.78	3.05E-03	89.30%
562.16	2.73E-03	88.80%
615.55	2.49E-03	88.34%
668.93	1.95E-03	87.95%
722.31	1.81E-03	87.62%
775.70	1.96E-03	87.29%
829.08	1.55E-03	86.98%
889.13	1.23E-03	86.70%
955.85	1.40E-03	86.41%
1022.57	1.22E-03	86.13%
1089.29	1.06E-03	85.88%
1196.00	8.04E-04	85.55%
1309.37	9.26E-04	85.23%
1472.75	8.01E-04	84.76%
1739.47	4.51E-04	84.21%
2026.18	3.47E-04	83.84%
2312.90	3.64E-04	83.50%
2599.62	2.96E-04	83.19%
2886.33	2.56E-04	82.93%
3173.05	2.41E-04	82.70%
3626.42	1.95E-04	82.37%

Data Evaluation Grade: Modeling Grade

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	02/12/07 159
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCGrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.89 °C
Average air flow rate:	181.81 SLPM
Average air temperature above drop:	42.68 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	1.4 %
Total agent % mass recovery:	16.4 %
Mass % recovery in vapor:	15.1 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.10 µg/min



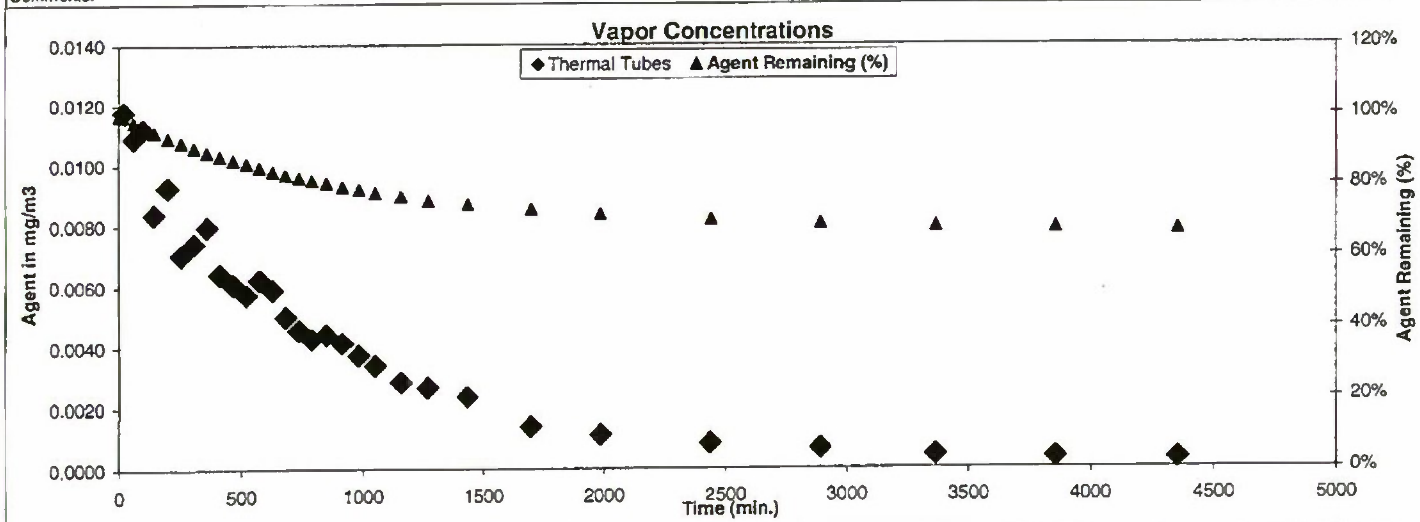
Time (min)	Conc. mg/m³	Agent rem. (%)
27.98	8.93E-03	99.59%
81.38	7.43E-03	98.15%
134.78	6.76E-03	96.90%
188.18	5.53E-03	95.82%
241.58	3.70E-03	95.00%
294.97	3.29E-03	94.39%
348.37	3.46E-03	93.80%
401.76	2.81E-03	93.25%
455.17	2.24E-03	92.80%
508.56	2.15E-03	92.41%
561.97	2.25E-03	92.03%
615.36	2.42E-03	91.62%
668.76	1.84E-03	91.24%
722.15	1.66E-03	90.93%
775.55	1.81E-03	90.65%
828.97	1.44E-03	90.38%
889.03	1.23E-03	90.11%
955.75	1.30E-03	89.84%
1022.49	1.39E-03	89.54%
1089.22	1.10E-03	89.26%
1195.93	9.18E-04	88.91%
1309.32	9.57E-04	88.56%
1472.70	9.41E-04	88.05%
1739.42	5.41E-04	87.40%
2026.13	5.35E-04	86.89%
2312.83	4.33E-04	86.43%
2682.88	3.57E-04	85.95%
3052.93	3.13E-04	85.54%
3422.98	2.46E-04	85.20%
3793.03	2.09E-04	84.92%

27. Copy of 20070405_3c_207.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#09/GCMSD
Date/Experiment #:	04/05/07 207
Type of substrate :	CZ04 Concrete
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.05 °C
Average air flow rate:	181.43 SLPM
Average air temperature above drop:	41.96 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	32.9 %
Total agent % mass recovery:	32.9 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.50 µg/min



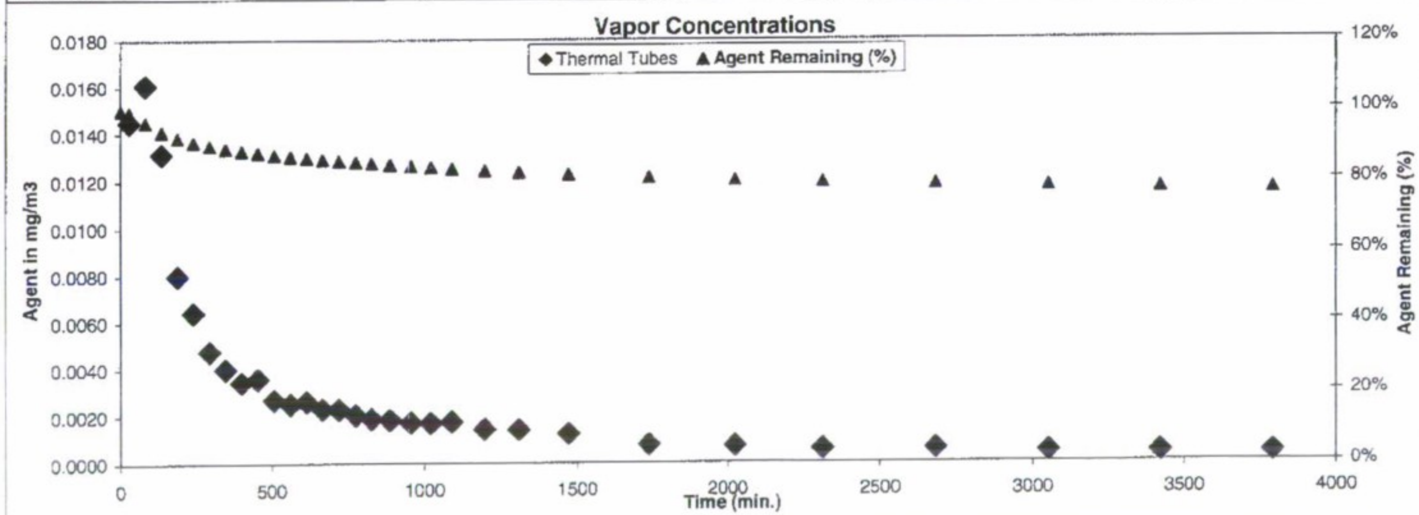
Time (min)	Conc. mg/m³	Agent rem. (%)
20.98	1.18E-02	99.59%
61.03	1.09E-02	98.10%
101.10	1.12E-02	96.64%
147.83	8.40E-03	95.14%
201.22	9.27E-03	93.59%
254.61	7.04E-03	92.15%
308.02	7.42E-03	90.88%
361.41	7.98E-03	89.53%
414.80	6.43E-03	88.27%
468.20	6.08E-03	87.17%
521.60	5.74E-03	86.13%
575.00	6.24E-03	85.08%
628.38	5.91E-03	84.01%
681.78	5.03E-03	83.05%
735.18	4.57E-03	82.21%
788.58	4.28E-03	81.43%
848.65	4.43E-03	80.57%
915.37	4.14E-03	79.63%
982.10	3.74E-03	78.76%
1048.83	3.40E-03	77.98%
1155.53	2.85E-03	76.88%
1268.92	2.67E-03	75.85%
1432.30	2.36E-03	74.50%
1699.02	1.38E-03	72.86%
1985.72	1.11E-03	71.69%
2439.10	8.33E-04	70.23%
2892.48	6.43E-04	69.13%
3365.87	4.24E-04	68.30%
3859.23	3.51E-04	67.67%
4352.62	3.02E-04	67.14%

18. Copy of 20070409_3c_208.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3c
Instruments:	VTS#09/GCMSD#1
Date/Experiment #:	04/09/07 208
Type of substrate :	CZ04 Concrete
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	41.79 °C
Average air flow rate:	181.52 SLPM
Average air temperature above drop:	41.97 °C
CCVs within criteria:	No
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	22.8 %
Total agent % mass recovery:	22.8 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 2.50 µg/min



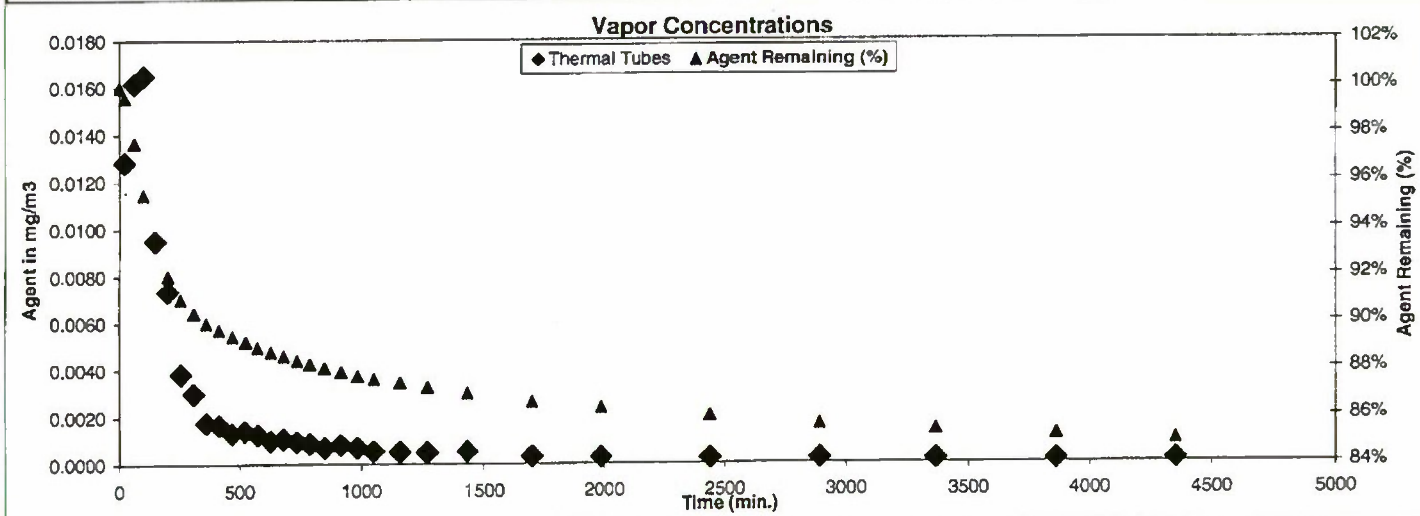
Time (min)	Conc. mg/m^3	Agent rem. (%)
27.72	1.45E-02	99.34%
81.10	1.61E-02	96.65%
134.50	1.31E-02	94.09%
187.90	7.99E-03	92.23%
241.30	6.42E-03	90.96%
294.68	4.75E-03	89.98%
348.08	4.00E-03	89.21%
401.48	3.44E-03	88.56%
454.86	3.57E-03	87.94%
508.27	2.69E-03	87.39%
561.67	2.51E-03	86.93%
615.06	2.63E-03	86.48%
668.45	2.29E-03	86.05%
721.85	2.28E-03	85.65%
775.25	2.06E-03	85.27%
828.65	1.89E-03	84.92%
888.72	1.84E-03	84.55%
955.44	1.72E-03	84.16%
1022.17	1.71E-03	83.79%
1088.90	1.76E-03	83.40%
1195.62	1.42E-03	82.85%
1308.98	1.38E-03	82.32%
1472.37	1.23E-03	81.62%
1739.08	7.41E-04	80.76%
2025.80	6.96E-04	80.08%
2312.50	5.52E-04	79.49%
2682.55	5.63E-04	78.81%
3052.60	4.46E-04	78.20%
3422.63	4.03E-04	77.68%
3792.68	3.83E-04	77.20%

28. Copy of 20070405_3a_170.xls

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3a
Instruments:	VTS#08/GCMSD
Date/Experiment #:	04/05/07 170
Type of substrate :	CZ04 Concrete
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	6 µL
Mass of agent disseminated:	6.06 mg
Corrected mass on 100% agent purity:	5.51 mg
Average substrate temperature:	42.26 °C
Average air flow rate:	181.58 SLPM
Average air temperature above drop:	42.55 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	15.0 %
Total agent % mass recovery:	15.0 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 2.60 µg/min

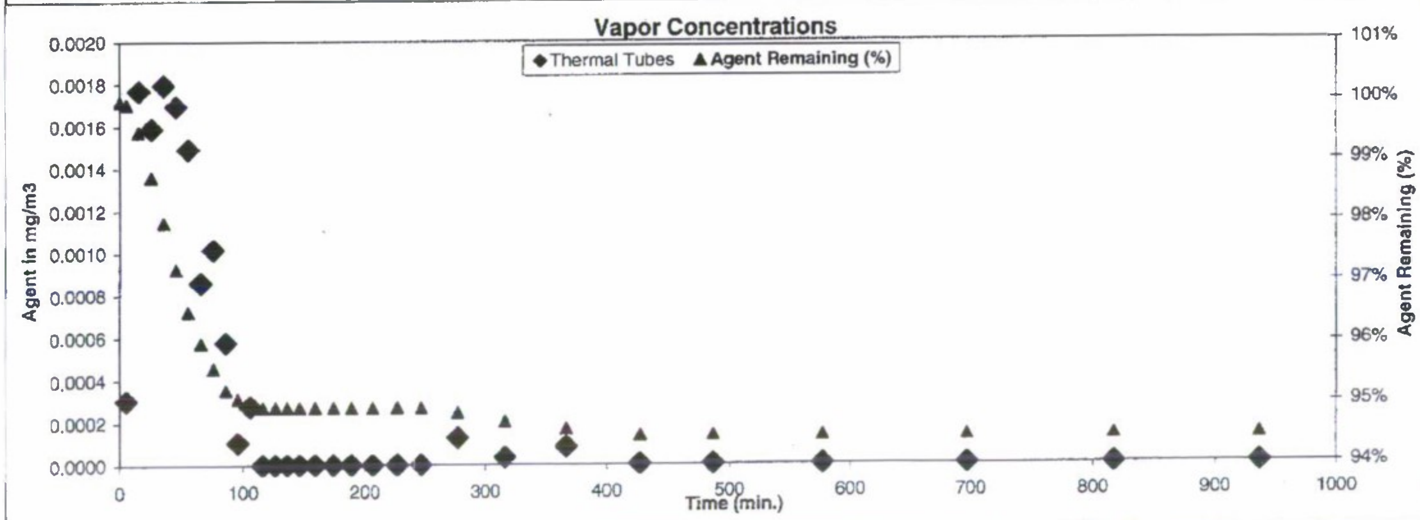


Time (min)	Conc. mg/m³	Agent rem. (%)
21.58	1.28E-02	99.54%
61.63	1.62E-02	97.63%
101.70	1.65E-02	95.48%
148.43	9.49E-03	93.48%
201.83	7.35E-03	92.00%
255.23	3.82E-03	91.02%
308.63	3.00E-03	90.42%
362.03	1.77E-03	90.00%
415.43	1.67E-03	89.70%
468.81	1.32E-03	89.44%
522.22	1.42E-03	89.20%
575.61	1.25E-03	88.96%
629.02	9.99E-04	88.76%
682.42	1.06E-03	88.58%
735.81	9.45E-04	88.40%
789.22	8.74E-04	88.24%
849.28	7.12E-04	88.09%
916.02	8.09E-04	87.92%
982.75	6.90E-04	87.75%
1049.49	5.45E-04	87.62%
1156.20	5.01E-04	87.43%
1269.57	4.81E-04	87.25%
1432.95	5.11E-04	86.98%
1699.67	2.94E-04	86.63%
1986.38	2.64E-04	86.37%
2439.77	2.20E-04	86.01%
2893.15	2.05E-04	85.69%
3366.53	1.47E-04	85.41%
3859.92	1.29E-04	85.19%
4353.30	1.28E-04	84.98%

11. Copy of 20070312_3l_063.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3L	
Instruments:	VTS#10/GCMSD#	
Date/Experiment #:	03/12/07	63
Type of substrate :	C0.45-83-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	1 µL	
Mass of agent disseminated:	1.01 mg	
Corrected mass on 100% agent purity:	0.92 mg	
Average substrate temperature:	49.91 °C	
Average air flow rate:	405.66 SLPM	
Average air temperature above drop:	49.78 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	5.5 %	
Total agent % mass recovery:	5.5 %	Raw evaporation rate: 0.65 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

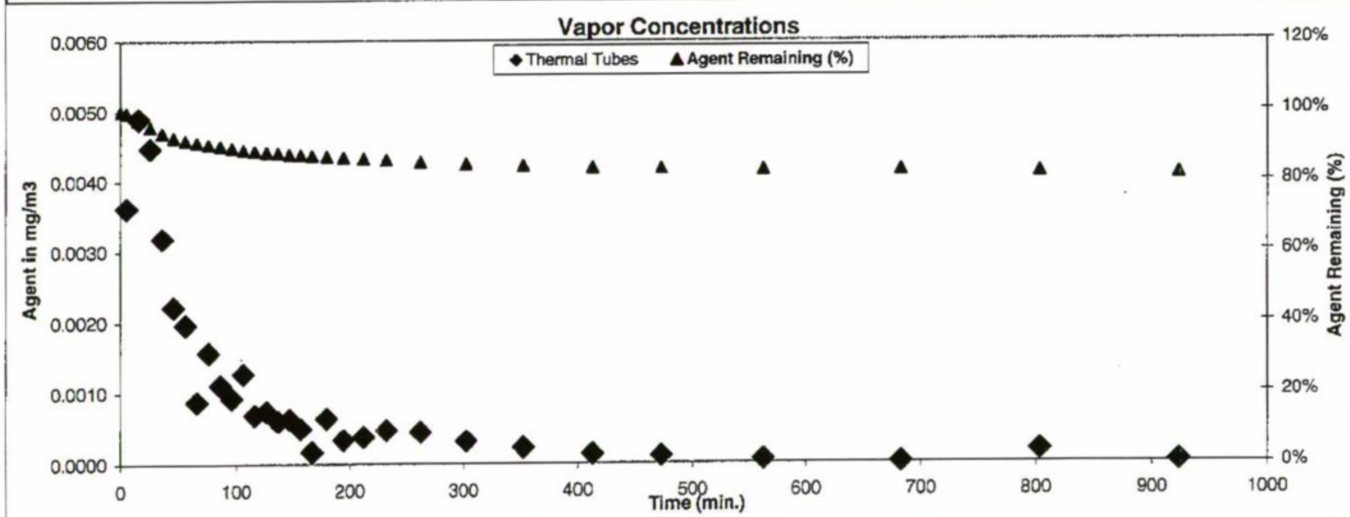


Time (min)	Conc. mg/m^3	Agent rem. (%)
5.47	3.03E-04	99.96%
15.52	1.77E-03	99.50%
25.58	1.59E-03	98.76%
35.65	1.79E-03	98.01%
45.72	1.69E-03	97.23%
55.77	1.49E-03	96.53%
65.83	8.60E-04	96.00%
75.90	1.02E-03	95.59%
85.97	5.76E-04	95.23%
96.02	1.03E-04	95.08%
106.08	2.75E-04	95.00%
116.15	0.00E+00	94.94%
126.20	0.00E+00	94.94%
136.27	0.00E+00	94.94%
146.33	0.00E+00	94.94%
158.90	0.00E+00	94.94%
173.97	0.00E+00	94.94%
189.02	0.00E+00	94.94%
206.58	0.00E+00	94.94%
226.65	0.00E+00	94.94%
246.72	0.00E+00	94.94%
276.77	1.26E-04	94.85%
316.83	3.26E-05	94.71%
366.90	8.22E-05	94.59%
426.97	0.00E+00	94.48%
487.02	0.00E+00	94.48%
577.08	0.00E+00	94.48%
697.15	0.00E+00	94.48%
817.20	0.00E+00	94.48%
937.27	0.00E+00	94.48%

Data Evaluation Grade: Modeling Grade

Tunnel:	3k
Instruments:	VTS#11/GCMSD
Date/Experiment #:	02/12/07 056
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	49.50 °C
Average air flow rate:	406.35 SLPM
Average air temperature above drop:	49.83 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	0.7 %
Total agent % mass recovery:	18.8 %
Mass % recovery in vapor:	18.0 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.30 µg/min

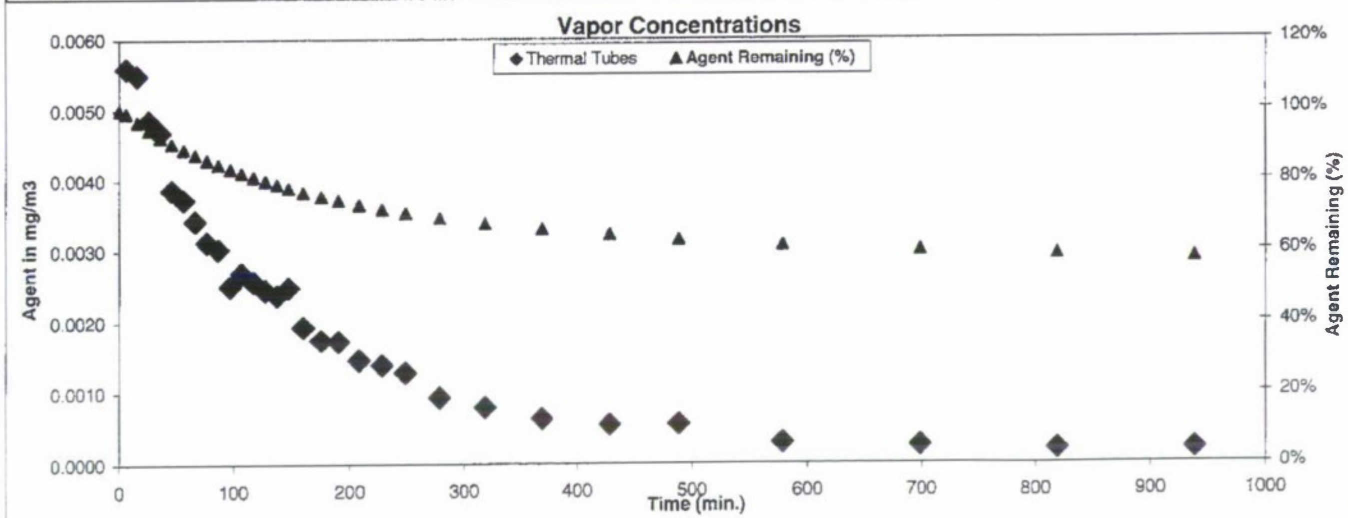


Time (min)	Conc. mg/m³	Agent rem. (%)
5.40	3.62E-03	99.57%
15.50	4.89E-03	97.67%
25.58	4.47E-03	95.58%
35.68	3.19E-03	93.87%
45.78	2.21E-03	92.66%
55.87	1.96E-03	91.73%
65.97	8.71E-04	91.10%
76.07	1.57E-03	90.56%
86.17	1.11E-03	89.96%
96.25	9.24E-04	89.51%
106.35	1.27E-03	89.02%
116.45	6.84E-04	88.58%
126.55	7.32E-04	88.26%
136.63	5.99E-04	87.97%
146.73	6.32E-04	87.69%
156.83	4.96E-04	87.44%
166.93	1.63E-04	87.29%
179.53	6.39E-04	87.07%
194.62	3.35E-04	86.75%
212.22	3.74E-04	86.47%
232.32	4.71E-04	86.09%
262.42	4.42E-04	85.49%
302.50	3.12E-04	84.82%
352.60	2.22E-04	84.23%
412.70	1.29E-04	83.76%
472.78	1.02E-04	83.45%
562.88	5.03E-05	83.15%
682.98	1.10E-05	82.99%
803.08	1.76E-04	82.49%
923.17	1.87E-05	81.97%

Data Evaluation Grade: Modeling Grade

Tunnel:	3k
Instruments:	VTS#11/GCMSD
Date/Experiment #:	02/05/07 054
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	47.97 °C
Average air flow rate:	398.86 SLPM
Average air temperature above drop:	49.92 °C
CCVs within criteria:	No
Mass % recovery by extraction:	0.0 %
Total agent % mass recovery:	42.1 %
Mass % recovery in vapor:	42.1 %
Tube #s consistant:	Yes
Comments:	video slightly overpredictes -tgd; 1 of 4 ccvs outside current criteria - cvg

Raw evaporation rate: 1.60 µg/min

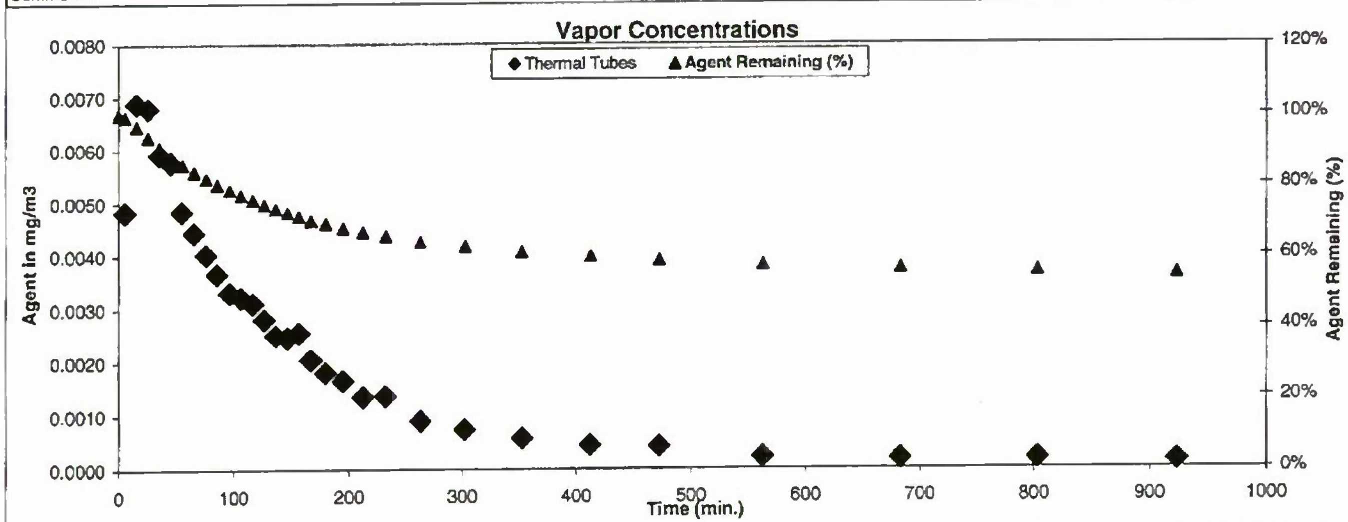


Time (min)	Conc. mg/m³	Agent rem. (%)
6.35	5.59E-03	99.23%
16.42	5.49E-03	96.81%
26.52	4.85E-03	94.54%
36.62	4.69E-03	92.45%
46.70	3.86E-03	90.58%
56.80	3.73E-03	88.92%
66.90	3.43E-03	87.35%
77.00	3.12E-03	85.91%
87.08	3.03E-03	84.57%
97.18	2.51E-03	83.36%
107.28	2.69E-03	82.22%
117.38	2.57E-03	81.06%
127.47	2.45E-03	79.96%
137.57	2.38E-03	78.91%
147.67	2.49E-03	77.84%
160.27	1.93E-03	76.63%
175.37	1.75E-03	75.43%
190.45	1.73E-03	74.29%
208.05	1.46E-03	73.07%
228.15	1.39E-03	71.83%
248.23	1.29E-03	70.66%
278.33	9.32E-04	69.21%
318.43	7.93E-04	67.71%
368.53	6.35E-04	66.16%
428.62	5.46E-04	64.62%
488.72	5.54E-04	63.18%
578.82	2.88E-04	61.54%
698.92	2.51E-04	60.13%
819.00	1.99E-04	58.96%
939.10	1.97E-04	57.93%

Data Evaluation Grade: Modeling Grade

Tunnel:	3I
Instruments:	VTS#10/GCMSD
Date/Experiment #:	02/12/07 055
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	49.85 °C
Average air flow rate:	406.10 SLPM
Average air temperature above drop:	49.78 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	0.6 %
Total agent % mass recovery:	46.0 %
Mass % recovery in vapor:	45.4 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 2.10 µg/min

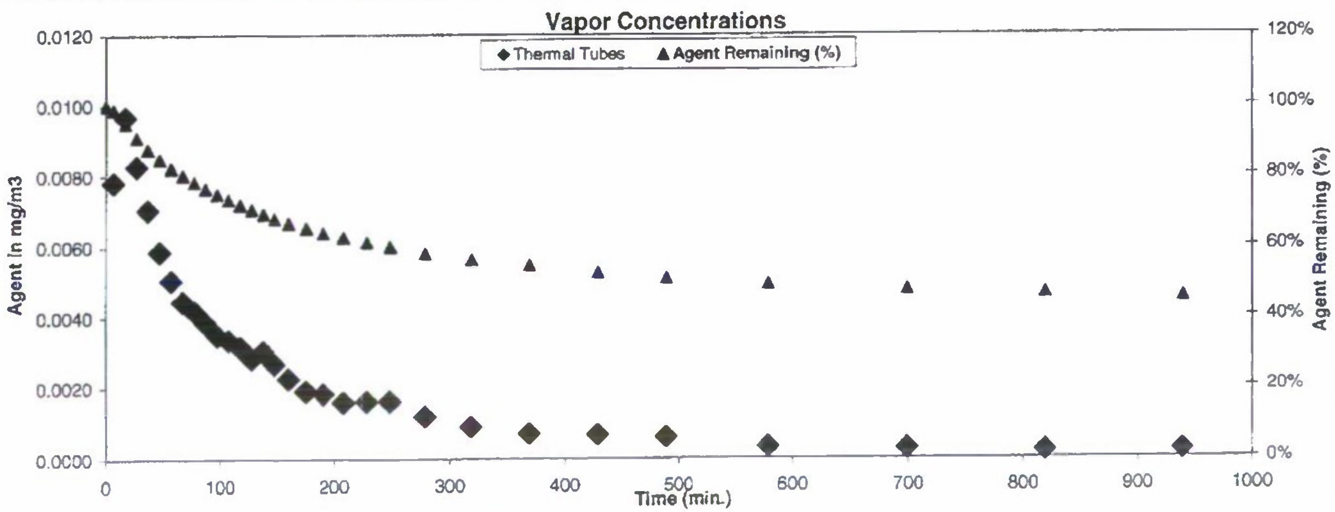


Time (min)	Conc. mg/m^3	Agent rem. (%)
5.48	4.83E-03	99.42%
15.58	6.88E-03	96.80%
25.68	6.78E-03	93.75%
35.78	5.91E-03	90.92%
45.87	5.76E-03	88.32%
55.97	4.84E-03	85.95%
66.07	4.44E-03	83.88%
76.17	4.03E-03	81.99%
86.25	3.67E-03	80.28%
96.35	3.31E-03	78.72%
106.45	3.22E-03	77.27%
116.55	3.11E-03	75.85%
126.63	2.81E-03	74.53%
136.73	2.51E-03	73.35%
146.83	2.46E-03	72.24%
156.93	2.55E-03	71.12%
167.02	2.05E-03	70.10%
179.62	1.80E-03	69.02%
194.72	1.65E-03	67.87%
212.32	1.34E-03	66.71%
232.40	1.36E-03	65.51%
262.50	8.94E-04	64.01%
302.60	7.38E-04	62.56%
352.68	5.70E-04	61.11%
412.78	4.40E-04	59.77%
472.88	4.16E-04	58.64%
562.98	2.11E-04	57.39%
683.07	1.72E-04	56.37%
803.17	1.73E-04	55.46%
923.27	1.34E-04	54.64%

Data Evaluation Grade: Modeling Grade

Tunnel:	3I
Instruments:	VTS#10/GCMSD
Date/Experiment #:	02/05/07 053
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	1 µL
Mass of agent disseminated:	1.01 mg
Corrected mass on 100% agent purity:	0.92 mg
Average substrate temperature:	49.67 °C
Average air flow rate:	403.62 SLPM
Average air temperature above drop:	49.74 °C
CCVs within criteria:	No
Mass % recovery by extraction:	0.0 %
Total agent % mass recovery:	54.5 %
Mass % recovery in vapor:	54.5 %
Tube #s consistant:	Yes
Comments:	1 of 3 ccvs outside current criteria - cvg

Raw evaporation rate: 2.90 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
6.43	7.82E-03	98.90%
16.50	9.67E-03	95.03%
26.60	8.28E-03	91.05%
36.70	7.05E-03	87.65%
46.78	5.87E-03	84.79%
56.88	5.06E-03	82.37%
66.98	4.45E-03	80.26%
77.08	4.20E-03	78.34%
87.17	3.85E-03	76.56%
97.27	3.49E-03	74.93%
107.37	3.35E-03	73.42%
117.47	3.16E-03	71.97%
127.55	2.83E-03	70.65%
137.65	3.03E-03	69.35%
147.75	2.68E-03	68.08%
160.35	2.25E-03	66.72%
175.45	1.90E-03	65.34%
190.53	1.83E-03	64.10%
208.13	1.58E-03	62.78%
228.23	1.60E-03	61.37%
248.32	1.61E-03	59.95%
278.42	1.18E-03	58.11%
318.52	8.75E-04	56.30%
368.62	6.96E-04	54.57%
428.70	6.63E-04	52.78%
488.80	5.87E-04	51.13%
578.90	3.19E-04	49.33%
698.98	2.67E-04	47.79%
819.08	2.00E-04	46.56%
939.18	2.11E-04	45.47%

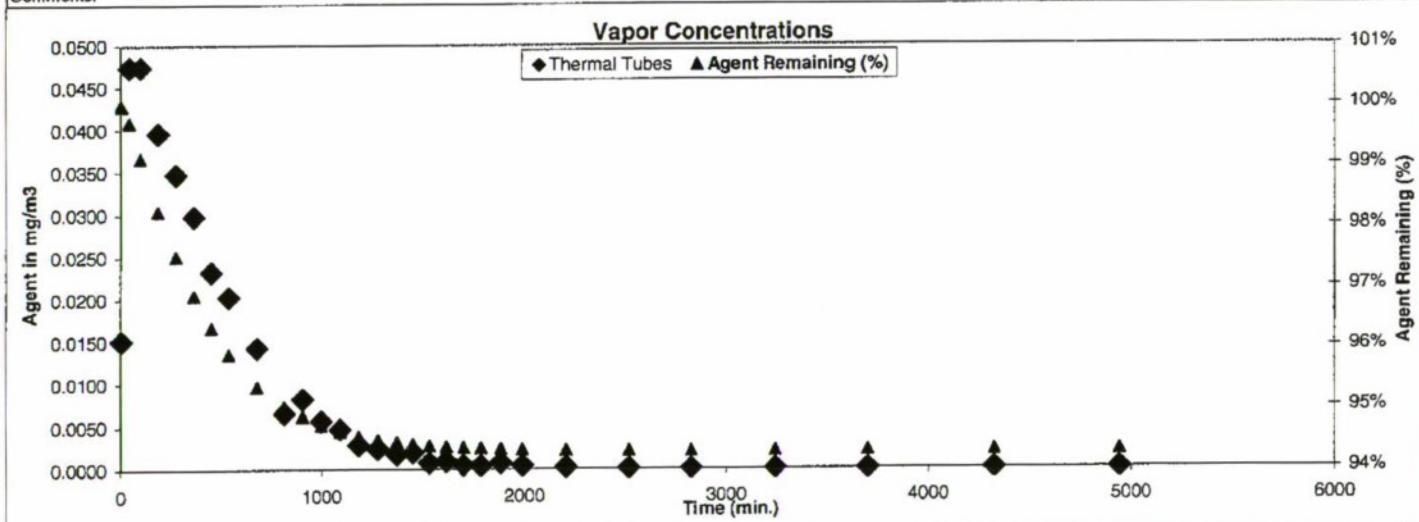
16. Copy of 20070315_3k_066.xls

Data Evaluation Grade: Modeling Grade

Tunnel:	3K
Instruments:	VTS#11/GCMSD#
Date/Experiment #:	03/15/07 66
Type of substrate :	C0.45-B3-23Feb05-Br
Test agent:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	48.70 °C
Average air flow rate:	18.78 SLPM
Average air temperature above drop:	49.11 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	n/a %
Mass % recovery in vapor:	5.7 %
Total agent % mass recovery:	5.7 %
Tube #s consistant:	Yes
Comments:	n/a

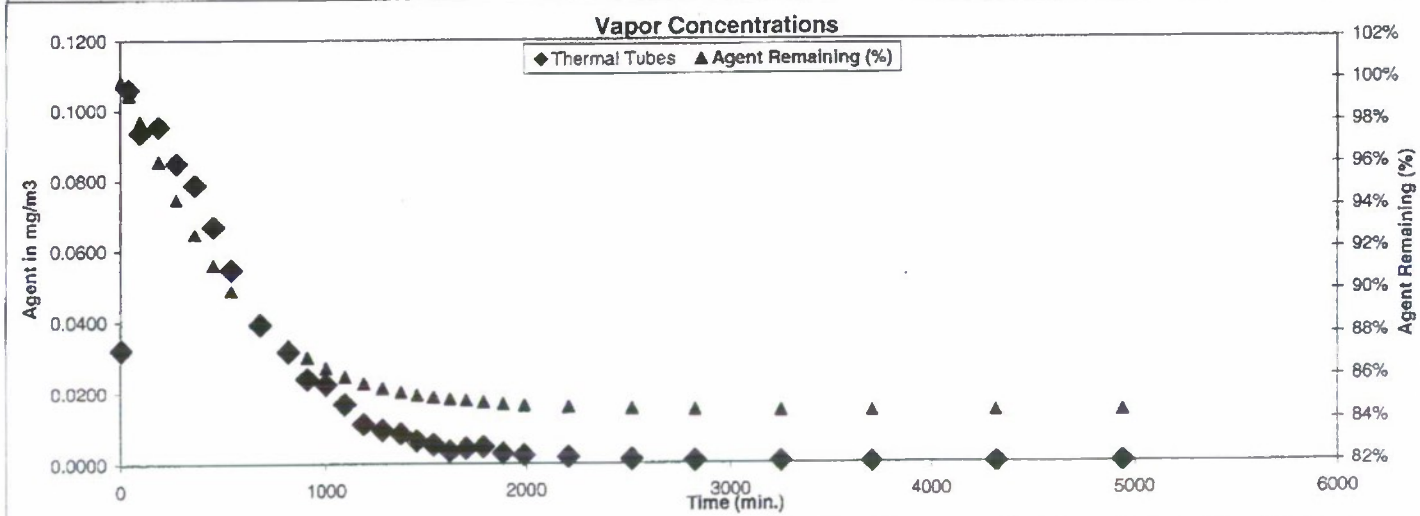
Raw evaporation rate: 0.69 µg/min

Time (min)	Conc. mg/m³	Agent rem. (%)
3.10	1.51E-02	99.99%
41.48	4.74E-02	99.72%
96.53	4.74E-02	99.13%
184.90	3.96E-02	98.26%
273.28	3.48E-02	97.51%
361.67	2.98E-02	96.86%
450.05	2.32E-02	96.33%
538.42	2.03E-02	95.90%
676.80	1.42E-02	95.35%
815.18	6.57E-03	95.03%
906.05	8.24E-03	94.87%
999.43	5.66E-03	94.73%
1092.82	4.66E-03	94.62%
1186.20	2.84E-03	94.54%
1279.57	2.40E-03	94.48%
1372.95	1.69E-03	94.44%
1452.17	1.92E-03	94.41%
1533.88	7.12E-04	94.38%
1615.60	8.88E-04	94.37%
1699.80	4.54E-04	94.35%
1786.52	3.73E-04	94.35%
1883.23	7.31E-04	94.33%
1989.95	3.74E-04	94.32%
2206.65	1.80E-04	94.31%
2516.70	2.28E-05	94.30%
2826.75	0.00E+00	94.30%
3250.12	0.00E+00	94.30%
3703.50	0.00E+00	94.30%
4323.55	0.00E+00	94.30%
4943.60	0.00E+00	94.30%



Data Evaluation Grade: **Modeling Grade**

Tunnel:	3L	
Instruments:	VTS#10/GCMSD#	
Date/Experiment #:	03/15/07	65
Type of substrate :	C0.45-B3-23Feb05-Br	
Test agent:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	49.58 °C	
Average air flow rate:	18.78 SLPM	
Average air temperature above drop:	49.47 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	n/a %	
Mass % recovery in vapor:	15.6 %	
Total agent % mass recovery:	15.6 %	Raw evaporation rate: 1.60 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

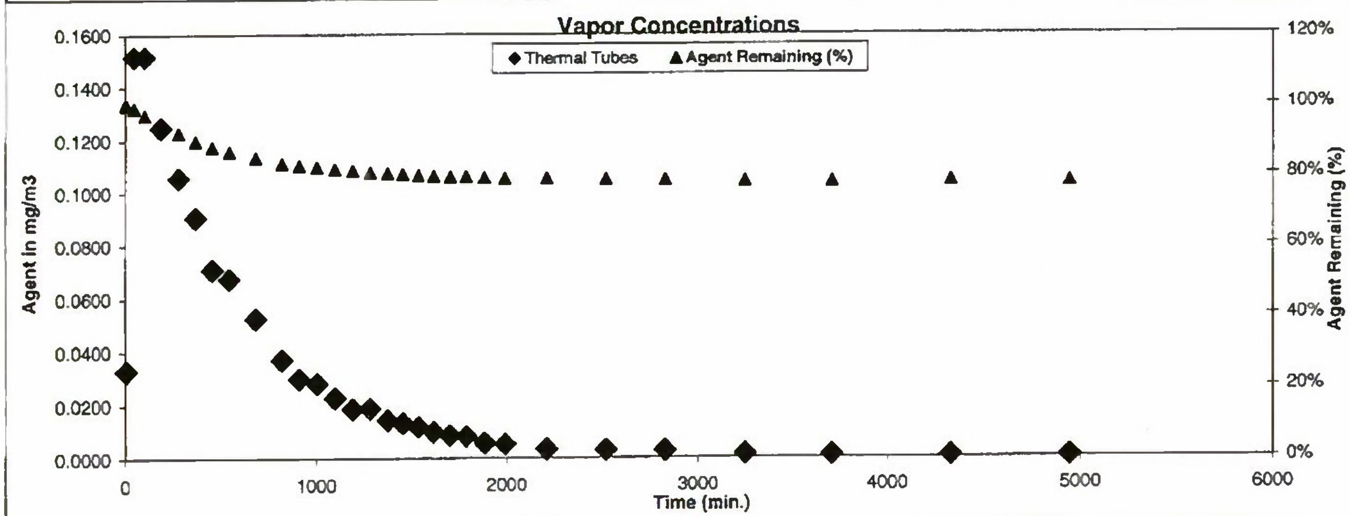


Time (min)	Conc. mg/m³	Agent rem. (%)
3.00	3.21E-02	99.99%
41.37	1.06E-01	99.39%
96.42	9.36E-02	98.14%
184.80	9.53E-02	96.25%
273.18	8.49E-02	94.44%
361.55	7.88E-02	92.80%
449.93	8.68E-02	91.34%
538.32	5.47E-02	90.12%
676.68	3.91E-02	88.64%
815.07	3.15E-02	87.54%
905.95	2.39E-02	86.96%
999.33	2.23E-02	86.48%
1092.70	1.68E-02	86.06%
1186.08	1.11E-02	85.77%
1279.47	9.43E-03	85.55%
1372.85	8.45E-03	85.36%
1452.07	6.46E-03	85.22%
1533.77	5.38E-03	85.11%
1615.48	3.47E-03	85.03%
1699.70	4.30E-03	84.96%
1786.42	4.64E-03	84.87%
1883.12	2.82E-03	84.79%
1989.83	2.24E-03	84.73%
2206.55	1.70E-03	84.63%
2516.58	1.03E-03	84.53%
2826.63	5.14E-04	84.48%
3250.02	3.24E-04	84.44%
3703.40	1.28E-04	84.42%
4323.43	9.90E-05	84.40%
4943.48	0.00E+00	84.39%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3I
Instruments:	VTS#10/GCMSD
Date/Experiment #:	02/01/07 052
Type of substrate :	Concrete(Cz04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	50.69 °C
Average air flow rate:	19.33 SLPM
Average air temperature above drop:	49.86 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	n/a %
Total agent % mass recovery:	22.1 %
Mass % recovery in vapor:	22.1 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 2.40 µg/min



Time (min)	Conc. mg/m³	Agent rem. (%)
7.45	3.30E-02	99.97%
45.83	1.52E-01	99.14%
100.88	1.52E-01	97.19%
189.25	1.25E-01	94.34%
277.63	1.06E-01	91.96%
366.02	9.05E-02	89.94%
454.38	7.09E-02	88.27%
542.77	5.74E-02	86.84%
681.15	5.24E-02	84.91%
819.53	3.70E-02	83.46%
910.40	2.99E-02	82.75%
1003.78	2.81E-02	82.12%
1097.17	2.26E-02	81.57%
1190.55	1.83E-02	81.12%
1283.92	1.86E-02	80.72%
1377.30	1.42E-02	80.36%
1456.52	1.31E-02	80.11%
1538.23	1.16E-02	79.87%
1619.95	9.80E-03	79.67%
1704.15	8.42E-03	79.49%
1790.87	8.10E-03	79.32%
1887.58	5.60E-03	79.17%
1994.30	5.10E-03	79.03%
2211.00	3.20E-03	78.82%
2521.05	2.81E-03	78.61%
2831.10	2.56E-03	78.41%
3254.47	1.28E-03	78.22%
3707.85	8.78E-04	78.11%
4327.90	5.34E-04	78.00%
4947.95	3.78E-04	77.94%

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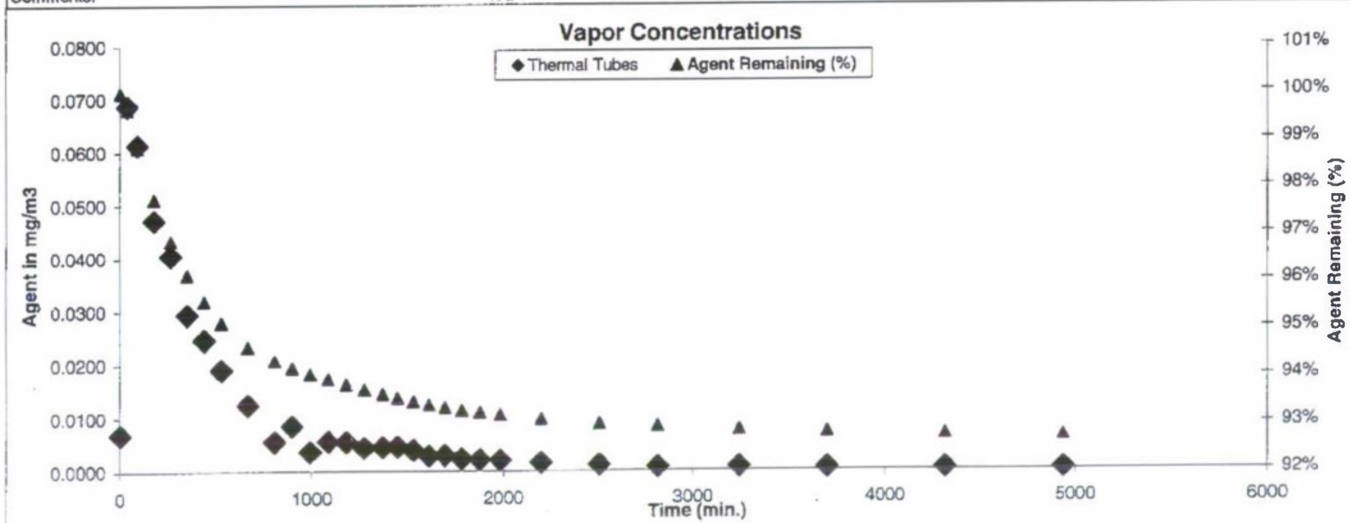
Data Evaluation Grade: Modeling Grade

Tunnel:	3k
Instruments:	VTS#11/GCMSD
Date/Experiment #:	02/08/07 055
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	47.33 °C
Average air flow rate:	19.35 SLPM
Average air temperature above drop:	47.88 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	3.4 %
Total agent % mass recovery:	10.6 %
Mass % recovery in vapor:	7.3 %
Tube #s consistant:	Yes
Comments:	n/a

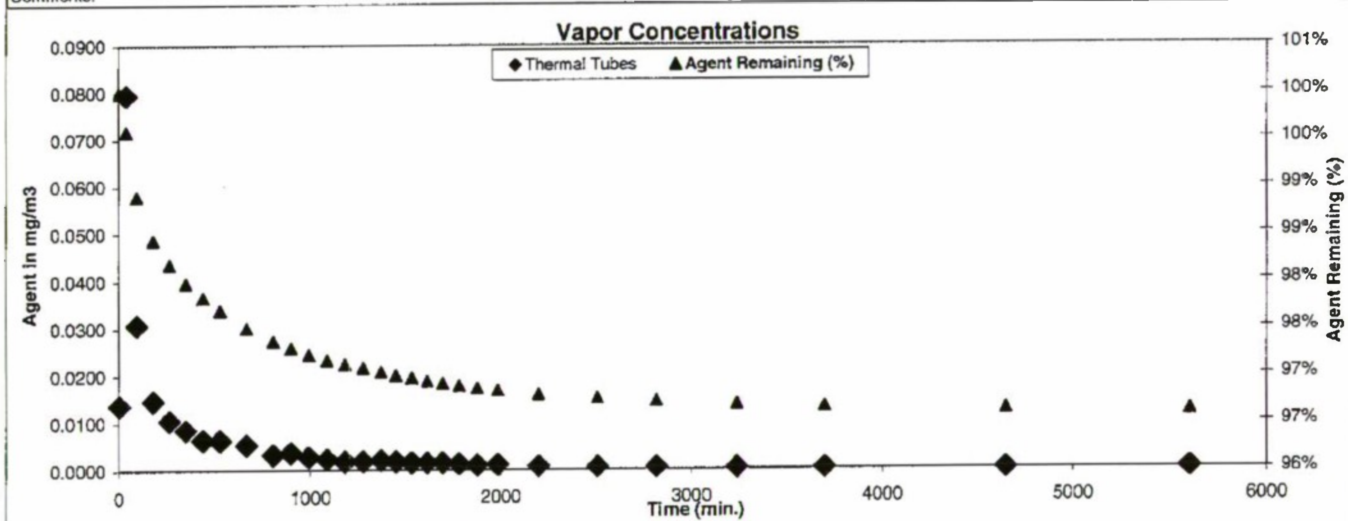
Raw evaporation rate: 0.92 µg/min



Time (min)	Conc. mg/m³	Agent rem. (%)
2.98	6.86E-03	100.00%
40.53	6.87E-02	99.67%
93.92	6.14E-02	98.85%
180.61	4.71E-02	97.75%
267.33	4.05E-02	96.86%
354.88	2.95E-02	96.15%
443.25	2.47E-02	95.59%
531.63	1.90E-02	95.14%
670.02	1.24E-02	94.63%
808.40	5.56E-03	94.33%
899.27	8.51E-03	94.19%
992.65	3.67E-03	94.05%
1086.03	5.60E-03	93.95%
1179.40	5.49E-03	93.83%
1272.78	4.43E-03	93.72%
1366.17	4.46E-03	93.62%
1445.38	4.54E-03	93.54%
1527.10	3.93E-03	93.46%
1608.82	2.87E-03	93.40%
1693.02	2.97E-03	93.34%
1779.73	2.27E-03	93.28%
1876.45	2.10E-03	93.24%
1983.15	2.02E-03	93.18%
2199.87	1.50E-03	93.09%
2509.92	1.10E-03	93.00%
2819.97	6.55E-04	92.94%
3243.33	6.50E-04	92.87%
3696.72	4.33E-04	92.82%
4316.77	3.24E-04	92.76%
4936.82	2.49E-04	92.72%

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3k	
Instruments:	VTS#11/GCMSD	
Date/Experiment #:	02/15/07	057
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	49.08 °C	
Average air flow rate:	19.40 SLPM	
Average air temperature above drop:	49.32 °C	
CCVs within criteria:	Yes	
Mass % recovery by extraction:	0.0 %	
Total agent % mass recovery:	3.4 %	
Mass % recovery in vapor:	3.4 %	Raw evaporation rate: 0.49 µg/min
Tube #s consistant:	Yes	
Comments:	n/a	

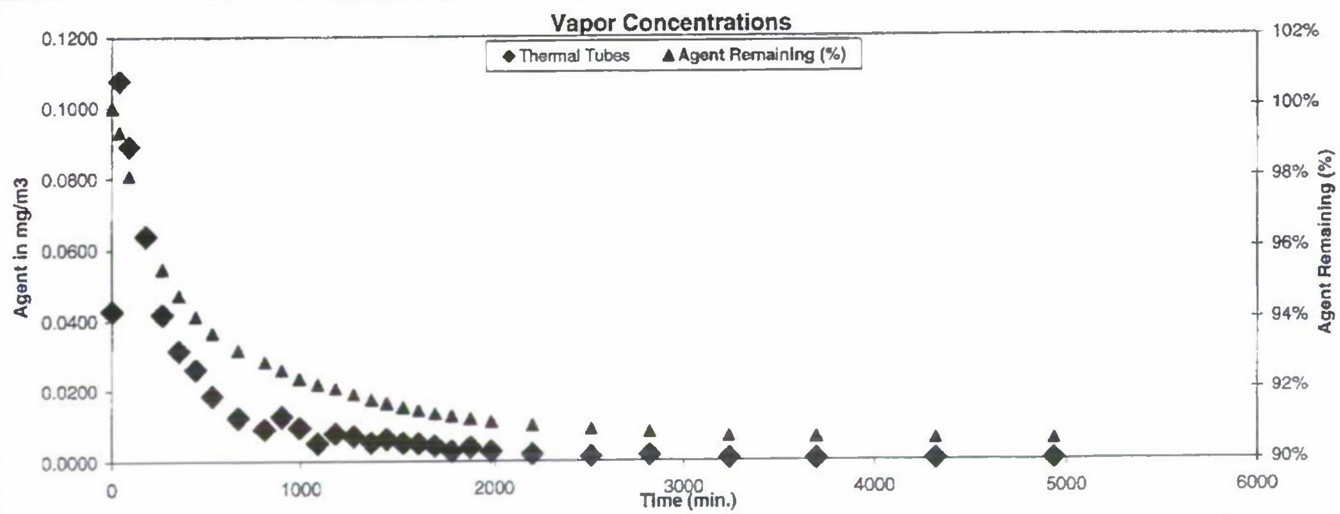


Time (min)	Conc. mg/m^3	Agent rem. (%)
3.12	1.38E-02	99.99%
40.67	7.94E-02	99.58%
94.03	3.08E-02	98.89%
180.75	1.47E-02	98.43%
267.46	1.05E-02	98.18%
355.02	8.48E-03	97.98%
443.38	6.37E-03	97.83%
531.77	8.33E-03	97.70%
670.15	5.40E-03	97.51%
808.53	3.28E-03	97.37%
899.40	3.68E-03	97.29%
992.78	2.79E-03	97.22%
1086.17	2.32E-03	97.16%
1179.53	1.79E-03	97.12%
1272.92	1.81E-03	97.08%
1366.30	2.05E-03	97.04%
1445.52	1.77E-03	97.00%
1527.23	1.47E-03	96.97%
1608.95	1.51E-03	96.94%
1693.15	1.46E-03	96.91%
1779.87	1.22E-03	96.89%
1876.58	8.71E-04	96.86%
1983.28	1.00E-03	96.84%
2200.00	6.80E-04	96.80%
2510.05	4.56E-04	96.75%
2820.10	4.34E-04	96.72%
3243.47	3.04E-04	96.69%
3696.85	1.73E-04	96.66%
4650.23	8.94E-05	96.63%
5603.62	7.28E-05	96.61%

5 Copy of VXC01E3I_HHLL_054_2007-02-08.xls

Data Evaluation Grade: **Modeling Grade**

Tunnel:	3I	
Instruments:	VTS#10/GCMSD	
Date/Experiment #:	02/08/07 054	
Type of substrate :	Concrete(CZ04)	
Test agent/purity:	VX_TCgrade	
Number of drops:	1	
Nominal drop volume:	9 µL	
Mass of agent disseminated:	9.09 mg	
Corrected mass on 100% agent purity:	8.27 mg	
Average substrate temperature:	49.61 °C	
Average air flow rate:	19.37 SLPM	
Average air temperature above drop:	49.65 °C	
CCVs within criteria:	No	
Mass % recovery by extraction:	0.7 %	
Total agent % mass recovery:	10.2 %	
Mass % recovery in vapor:	9.4 %	Raw evaporation rate: 1.40 µg/min
Tube #s consistant:	Yes	
Comments:	1 of 3 ccvs outside current criteria - cvg;	drop went right into concrete

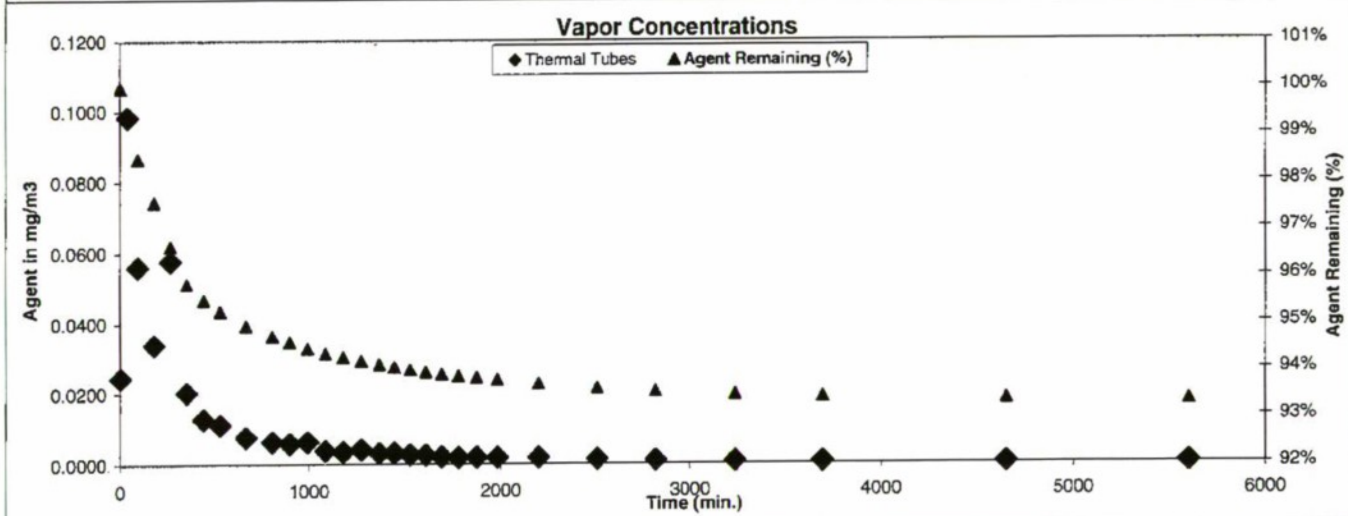


Time (min)	Conc. mg/m^3	Agent rem. (%)
2.97	4.28E-02	99.99%
40.51	1.08E-01	99.32%
93.90	8.92E-02	98.09%
180.61	6.39E-02	96.54%
267.31	4.18E-02	95.46%
354.87	3.14E-02	94.71%
443.25	2.61E-02	94.12%
531.62	1.85E-02	93.66%
670.00	1.23E-02	93.16%
808.38	9.09E-03	92.81%
899.27	1.26E-02	92.58%
992.63	9.51E-03	92.34%
1086.02	5.12E-03	92.18%
1179.40	7.80E-03	92.04%
1272.77	7.09E-03	91.87%
1366.17	5.23E-03	91.74%
1445.37	6.25E-03	91.63%
1527.08	5.20E-03	91.52%
1608.80	4.95E-03	91.42%
1693.02	4.29E-03	91.33%
1779.72	2.71E-03	91.26%
1876.43	3.76E-03	91.19%
1983.15	2.60E-03	91.11%
2199.85	1.79E-03	91.00%
2509.90	1.18E-03	90.89%
2819.95	1.48E-03	90.79%
3243.33	5.75E-04	90.69%
3696.70	3.87E-04	90.64%
4318.75	2.13E-04	90.60%
4936.80	1.85E-04	90.57%

Data Evaluation Grade: Modeling Grade

Tunnel:	3I
Instruments:	VTS#10/GCMSD
Date/Experiment #:	02/15/07 056
Type of substrate :	Concrete(CZ04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.09 mg
Corrected mass on 100% agent purity:	8.27 mg
Average substrate temperature:	49.74 °C
Average air flow rate:	19.38 SLPM
Average air temperature above drop:	50.68 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	0.5 %
Total agent % mass recovery:	7.1 %
Mass % recovery in vapor:	6.7 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 0.99 µg/min

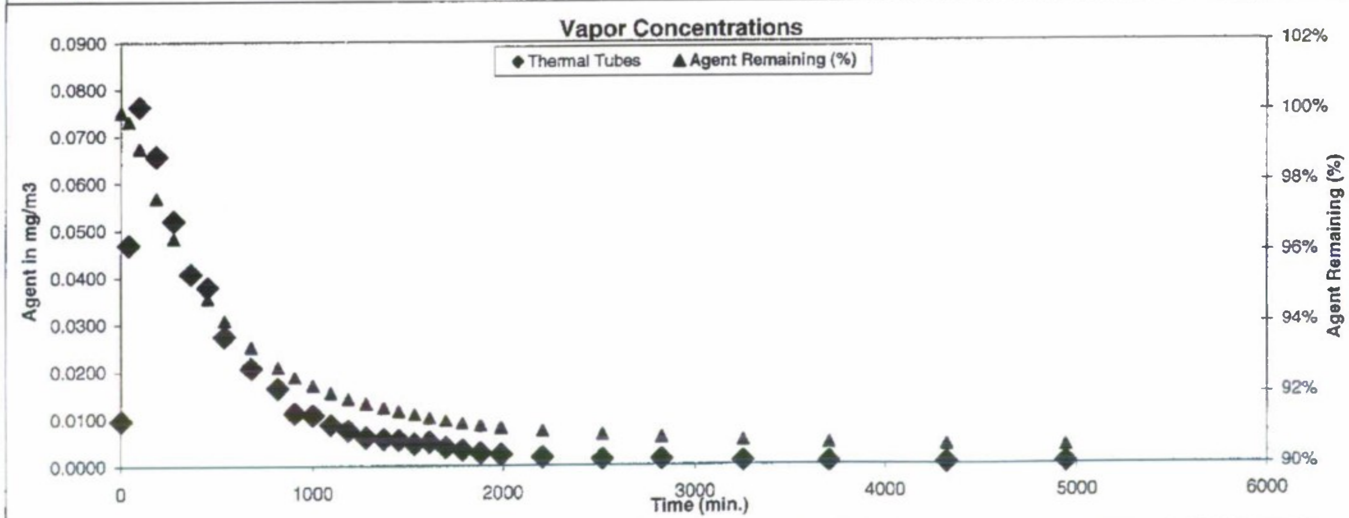


Time (min)	Conc. mg/m^3	Agent rem. (%)
2.97	2.44E-02	99.99%
40.50	9.84E-02	99.45%
93.88	5.60E-02	98.49%
180.60	3.39E-02	97.57%
267.31	5.76E-02	96.64%
354.85	2.03E-02	95.84%
443.23	1.28E-02	95.50%
531.62	1.11E-02	95.25%
669.98	7.61E-03	94.95%
808.37	6.33E-03	94.72%
899.25	5.80E-03	94.59%
992.63	6.26E-03	94.46%
1086.00	3.84E-03	94.35%
1179.38	3.44E-03	94.27%
1272.77	4.09E-03	94.19%
1366.15	3.04E-03	94.11%
1445.37	3.18E-03	94.05%
1527.07	2.66E-03	94.00%
1608.78	2.53E-03	93.95%
1693.00	2.01E-03	93.90%
1779.72	1.76E-03	93.87%
1876.42	1.84E-03	93.82%
1983.13	1.73E-03	93.78%
2199.85	1.59E-03	93.70%
2509.90	1.17E-03	93.60%
2819.93	7.96E-04	93.52%
3243.32	5.50E-04	93.46%
3696.70	3.50E-04	93.41%
4650.07	1.69E-04	93.35%
5603.45	1.01E-04	93.32%

Data Evaluation Grade: Modeling Grade

Tunnel:	3k
Instruments:	VTS#11/GCMSD
Date/Experiment #:	02/01/07 53
Type of substrate :	Concrete(Cz04)
Test agent/purity:	VX_TCgrade
Number of drops:	1
Nominal drop volume:	9 µL
Mass of agent disseminated:	9.50 mg
Corrected mass on 100% agent purity:	8.65 mg
Average substrate temperature:	49.43 °C
Average air flow rate:	19.36 SLPM
Average air temperature above drop:	50.23 °C
CCVs within criteria:	Yes
Mass % recovery by extraction:	2.4 %
Total agent % mass recovery:	11.9 %
Mass % recovery in vapor:	9.5 %
Tube #s consistant:	Yes
Comments:	n/a

Raw evaporation rate: 1.20 µg/min



Time (min)	Conc. mg/m^3	Agent rem. (%)
3.97	9.60E-03	100.00%
42.33	4.69E-02	99.75%
97.38	7.63E-02	98.99%
185.77	6.57E-02	97.59%
274.15	5.20E-02	96.42%
362.52	4.07E-02	95.51%
450.90	3.78E-02	94.73%
539.28	2.73E-02	94.08%
677.67	2.06E-02	93.34%
816.03	1.64E-02	92.77%
906.92	1.11E-02	92.49%
1000.30	1.07E-02	92.26%
1093.87	8.68E-03	92.06%
1187.05	7.39E-03	91.89%
1280.43	5.91E-03	91.75%
1373.82	5.56E-03	91.63%
1453.03	5.40E-03	91.53%
1534.75	4.62E-03	91.44%
1618.45	4.97E-03	91.35%
1700.67	3.89E-03	91.27%
1787.38	3.32E-03	91.20%
1884.08	2.74E-03	91.13%
1990.80	2.40E-03	91.07%
2207.52	1.71E-03	90.97%
2517.57	1.24E-03	90.87%
2827.60	1.19E-03	90.79%
3250.98	8.46E-04	90.69%
3704.37	5.89E-04	90.62%
4324.40	3.40E-04	90.55%
4944.45	3.53E-04	90.50%

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APPENDIX C

GD AND TGD ON STAINLESS STEEL, SAND AND CONCRETE WIND TUNNEL DATA

Conditions and Experimental Evaporation Rates for GD on Various Substrates

Temp-erature /°C	Air Flow /SLPM	Agent mass /mg	%GD recovered	Substrate	Evaporation Rate /μgmin^{-1}	Predicted Evaporation Rate /μgmin^{-1}	$\log_{10}$ Evaporation Rate /μgmin^{-1}	Predicted $\log_{10}$ Evaporation Rate /μgmin^{-1}
10	405	1.24	41.8	Concrete	70	326	1.8	1.8
10	18	9.79	22.7	Concrete	49	233	1.7	1.4
10	405	1.39	59.7	Concrete	136	323	2.1	1.9
10	18	9.28	30.2	Concrete	78	230	1.9	1.4
10	405	0.86	77.4	Concrete	87	317	1.9	1.9
10	18	9.05	27.6	Concrete	79	230	1.9	1.4
10	405	1.25	78.8	Concrete	151	318	2.2	1.9
25	181	7.29	38.7	Concrete	408	353	2.6	2.0
25	181	6.53	49.6	Concrete	314	348	2.5	2.1
25	181	6.7	41	Concrete	448	350	2.7	2.0
25	181	6.51	42.9	Concrete	441	349	2.6	2.0
25	181	6.41	40.2	Concrete	445	349	2.6	2.0
25	181	6.39	36.7	Concrete	382	350	2.6	2.0
42	405	9.68	62.2	Concrete	1263	518	3.1	3.0
42	18	1.75	29.9	Concrete	57	371	1.8	2.2
42	405	9.48	60.1	Concrete	1713	517	3.2	3.0
42	18	1.23	62.4	Concrete	133	362	2.1	2.3
42	405	9.49	66.3	Concrete	1832	516	3.3	3.0
42	18	1.41	48.9	Concrete	104	365	2.0	2.3
42	405	9.24	101.5	Concrete	1743	508	3.2	3.1
42	405	9.72	67.6	Concrete	1569	517	3.2	3.0
10	405	9.17	84.4	UKSand	42	275	1.6	1.8
10	18	40.77	95.9	UKSand	36	255	1.6	1.9
10	405	9.29	97.7	UKSand	47	272	1.7	1.8
10	18	39.41	127.2	UKSand	38	244	1.6	2.0
10	405	8.98	103.4	UKSand	49	270	1.7	1.8
10	18	39.49	124.5	UKSand	37	245	1.6	2.0
25	181	9.87	70.5	UKSand	101	285	2.0	1.9
25	181	19.99	100.5	UKSand	142	314	2.2	2.2
25	181	6.22	88	UKSand	108	269	2.0	1.9
25	181	6.08	86.4	UKSand	100	269	2.0	1.9
25	181	19.27	90.2	UKSand	110	314	2.0	2.1
25	181	20.48	89.5	UKSand	105	318	2.0	2.1
42	18	8.73	88.1	UKSand	126	313	2.1	2.2
42	18	0.9	95	UKSand	64	284	1.8	2.1
42	18	8.79	83.6	UKSand	122	314	2.1	2.2
42	405	40.84	102.1	UKSand	582	548	2.8	3.4
42	18	9.01	91.8	UKSand	158	313	2.2	2.2
42	405	40.05	108.3	UKSand	696	543	2.8	3.4
42	18	10.72	96	UKSand	154	318	2.2	2.3
42	405	41	83.8	UKSand	559	552	2.7	3.3
42	18	9.36	77.8	UKSand	117	317	2.1	2.2

10	405	1.17	81	SS	26	316	1.4	1.8
10	18	9.22	90.6	SS	27	215	1.4	1.5
10	405	1.13	90.4	SS	27	313	1.4	1.9
10	18	9.42	95.4	SS	45	215	1.7	1.5
10	405	1.33	136.4	SS	49	304	1.7	2.0
10	18	9.37	134.7	SS	45	206	1.7	1.7
25	181	6.08	137	SS	185	326	2.3	2.3
25	181	5.89	116	SS	197	330	2.3	2.2
25	181	5.83	128.1	SS	228	327	2.4	2.2
25	181	6.25	113.8	SS	252	331	2.4	2.2
42	405	9.24	113.2	SS	1462	504	3.2	3.1
42	18	1.13	122.7	SS	125	347	2.1	2.4
42	405	9.32	84.5	SS	1125	510	3.1	2.9
42	18	1.07	67.3	SS	72	359	1.9	2.2
42	405	9.31	91.3	SS	1015	508	3.0	3.0
42	18	0.89	171.6	SS	153	336	2.2	2.6

Conditions and Experimental Evaporation Rates for TGD on Various Substrates

Temp-erature /°C	Air Flow /SLPM	Agent mass /mg	%GD recovered	Substrate	Evaporation Rate /μgmin^{-1}	Predicted Evaporation Rate /μgmin^{-1}	$\log_{10}$ Evaporation Rate /μgmin^{-1}	Predicted $\log_{10}$ Evaporation Rate /μgmin^{-1}
10	405	1.3	84.9	Concrete	19	71	1.3	1.4
10	18	9.2	85.6	Concrete	11	-28	1.0	1.0
10	405	1.3	51.5	Concrete	10	78	1.0	1.3
10	18	8.9	82.5	Concrete	10	-28	1.0	1.0
10	405	10.02	93.6	Concrete	101	100	2.0	1.6
10	18	9.55	89.5	Concrete	13	-28	1.1	1.0
10	405	1.3	105.2	Concrete	22	67	1.3	1.5
10	405	1.26	94.1	Concrete	31	69	1.5	1.4
10	18	0.95	102.1	Concrete	6	-60	0.8	0.9
10	405	9.4	99	Concrete	65	96	1.8	1.6
10	405	1.73	59.2	Concrete	22	78	1.3	1.3
10	18	1.15	77.4	Concrete	4	-54	0.6	0.8
10	405	8.89	82.4	Concrete	45	98	1.7	1.5
10	18	1.06	85.5	Concrete	3	-56	0.5	0.9
25	181	5.91	87.8	Concrete	99	92	2.0	1.6
25	181	6.53	91.1	Concrete	110	93	2.0	1.7
25	181	5.92	91.6	Concrete	102	91	2.0	1.6
25	181	6.07	80.8	Concrete	86	94	1.9	1.6
42	405	9.87	74.7	Concrete	440	270	2.6	2.5
42	18	1.39	63.2	Concrete	41	116	1.6	1.7
42	405	8.74	65.7	Concrete	311	268	2.5	2.4
42	18	1.1	55.6	Concrete	32	117	1.5	1.7
42	405	10.56	101.4	Concrete	508	266	2.7	2.6
42	18	10.43	61.4	Concrete	184	148	2.3	1.9

42	405	1.57	66	Concrete	162	243	2.2	2.3
42	18	1.2	72.3	Concrete	48	114	1.7	1.8
42	18	9.73	124	Concrete	213	132	2.3	2.1
42	405	1.3	64.4	Concrete	141	242	2.1	2.3
42	18	9.25	100.6	Concrete	157	136	2.2	2.0
42	405	1.77	42.2	Concrete	117	249	2.1	2.2
10	405	35.98	85.9	UKSand	27	121	1.4	1.7
10	18	39.53	110.8	UKSand	13	2	1.1	1.4
10	405	50.23	105.3	UKSand	37	167	1.6	2.1
10	18	39.33	127.4	UKSand	16	-2	1.2	1.4
10	405	8.37	106.1	UKSand	12	21	1.1	1.3
10	18	8.33	102.7	UKSand	7	-104	0.8	0.7
10	405	39.69	120.4	UKSand	32	127	1.5	1.9
10	18	37.08	122.1	UKSand	15	-9	1.2	1.3
10	18	9.1	84.9	UKSand	5	-98	0.7	0.7
10	405	9.11	89.2	UKSand	9	28	1.0	1.2
10	18	8.73	80.5	UKSand	4	-98	0.6	0.7
10	405	8.35	78.3	UKSand	9	27	1.0	1.2
25	181	7.14	29.4	UKSand	30	38	1.5	1.1
25	181	13.24	82	UKSand	31	48	1.5	1.4
25	181	19.82	88.9	UKSand	45	70	1.7	1.6
25	181	19.7	88.9	UKSand	43	69	1.6	1.6
42	18	39.31	151.2	UKSand	186	159	2.3	2.4
42	18	40.39	107.6	UKSand	152	172	2.2	2.3
42	18	40.73	155.4	UKSand	202	163	2.3	2.5
42	18	40.07	119.8	UKSand	157	169	2.2	2.3
42	405	8.27	96.2	UKSand	104	190	2.0	2.2
42	18	8.77	93.9	UKSand	67	66	1.8	1.6
42	405	38.46	128.7	UKSand	289	288	2.5	2.9
42	18	8.39	94.5	UKSand	69	64	1.8	1.6
42	18	8.64	84.6	UKSand	56	67	1.7	1.6
42	405	9.16	90.7	UKSand	105	194	2.0	2.2
42	18	8.18	76.1	UKSand	51	67	1.7	1.6
42	405	40.16	95.2	UKSand	248	301	2.4	2.8
42	405	8.81	87.1	UKSand	93	194	2.0	2.1
42	405	39.82	92.1	UKSand	234	300	2.4	2.7
10	405	0.87	131	SS	18	58	1.3	1.4
10	18	0.95	83.2	SS	4	-58	0.6	0.8
10	405	8.95	114	SS	58	90	1.8	1.5
10	18	8.99	94.2	SS	13	-32	1.1	0.9
10	405	1	78.4	SS	13	70	1.1	1.3
10	18	9.12	71.6	SS	10	-27	1.0	0.9
10	405	8.96	132.6	SS	62	86	1.8	1.6
10	18	8.86	128	SS	15	-40	1.2	1.1
10	405	8.93	130.3	SS	63	86	1.8	1.6
10	18	8.72	127.5	SS	14	-40	1.1	1.1
10	405	0.87	111.5	SS	14	62	1.1	1.4

10	18	0.73	155.8	SS	4	-74	0.6	1.0
10	405	0.82	112	SS	17	62	1.2	1.4
10	18	1.03	90.5	SS	3	-59	0.5	0.8
25	181	5.77	92.5	SS	78	88	1.9	1.5
25	181	5.45	90	SS	73	88	1.9	1.5
25	181	4.02	104	SS	61	80	1.8	1.5
25	181	4.3	115	SS	82	78	1.9	1.6
42	405	0.96	87.6	SS	140	234	2.1	2.2
42	405	8.5	104	SS	501	257	2.7	2.4
42	18	9.28	97.9	SS	170	135	2.2	1.9
42	18	1.06	103	SS	55	105	1.7	1.8
42	405	8.81	87.4	SS	475	261	2.7	2.4
42	18	0.56	159	SS	50	91	1.7	2.0
42	18	1.1	121	SS	56	101	1.7	1.8
42	18	0.83	125.3	SS	46	99	1.7	1.8
42	18	6.11	112	SS	129	121	2.1	1.9
42	18	6.81	108	SS	124	124	2.1	1.9
42	18	1.09	151	SS	67	95	1.8	1.9
42	18	1.06	128	SS	61	100	1.8	1.9
42	405	8.13	93.8	SS	478	258	2.7	2.4
42	405	0.65	117.1	SS	160	227	2.2	2.3
42	18	8.95	129.1	SS	180	127	2.3	2.0
42	405	1.09	117.4	SS	197	228	2.3	2.3

Blank

APPENDIX D

TIME TAKEN TO REACH STEL FOR H AND IDLH FOR VX

Code	Substrate	Agent	Time to 0.003 mg m^{-3} /min	Measured Log_{10}(Time to 0.003 mg m^{-3}) /min	Predicted Log_{10}(Time to 0.003 mg m^{-3}) /min	Temp-erature /°C	Air Flow Rate, SLPM	Wind Speed /m s^{-1}	Drop Mass /mg
3d076	Concrete	H	160	2.20	2.58	14.0	405	3.3	9.1
3d061	Concrete	H	3400	3.53	3.32	14.8	19	0.22	9.1
3d064	Concrete	H	6100	3.79	3.32	14.8	18.1	0.22	9.1
3d070	Concrete	H	58	1.76	2.17	15.0	404	3.3	1.0
3d075	Concrete	H	236	2.37	2.56	15.0	403	3.3	9.1
3d066	Concrete	H	105	2.02	2.16	15.2	405	3.3	1.0
3d059	Concrete	H	773	2.89	3.31	15.2	19	0.22	9.1
3d058	Concrete	H	1600	3.20	2.92	15.2	18.2	0.22	1.0
3d072	Concrete	H	6000	3.78	3.31	15.2	18.1	0.22	9.1
3d069	Concrete	H	92	1.96	2.16	15.3	404	3.3	1.0
3d071	Concrete	H	370	2.57	2.56	15.3	405	3.3	9.1
3d067	Concrete	H	734	2.87	2.91	15.3	18.1	0.22	1.0
3d060	Concrete	H	440	2.64	2.55	15.5	396	3.3	9.1
3d065	Concrete	H	1145	3.06	2.91	15.5	18.1	0.22	1.0
3a138	Concrete	H	180	2.26	2.48	34.6	180	1.5	6.1
3a129	Concrete	H	850	2.93	2.47	34.7	182	1.5	6.1
3a111	Concrete	H	120	2.08	2.47	34.8	182	1.5	6.1
3a109	Concrete	H	333	2.52	2.54	34.8	182	1.5	7.5
3a134	Concrete	H	254	2.40	2.47	34.9	180	1.5	6.1
3a108	Concrete	H	256	2.41	2.47	34.9	182	1.5	6.1
3a110	Concrete	H	80	1.90	2.47	35.1	182	1.5	6.1
3a107	Concrete	H	181	2.26	2.54	35.1	182	1.5	7.5
3a137	Concrete	H	240	2.38	2.46	35.3	181	1.5	6.1
3c149	Concrete	H	460	2.66	2.53	35.4	181	1.5	7.5
3c150	Concrete	H	900	2.95	2.46	35.4	181	1.5	6.1
3c152	Concrete	H	543	2.73	2.45	35.7	181	1.5	6.1
3c151	Concrete	H	543	2.73	2.52	35.8	182	1.5	7.5
3a135	Concrete	H	564	2.75	2.28	48.3	18.2	0.22	1.0
3a136	Concrete	H	700	2.85	2.26	49.1	18	0.22	1.0
3a128	Concrete	H	580	2.76	2.25	49.4	18	0.22	1.0
3c161	Concrete	H	51	1.71	1.50	49.6	405	3.3	1.0
3c160	Concrete	H	386	2.59	2.65	49.6	18.5	0.22	9.1
3a120	Concrete	H	110	2.04	1.89	49.7	405	3.3	9.1
3a117	Concrete	H	55	1.74	1.89	49.8	405	3.3	9.1
3a118	Concrete	H	75	1.88	2.24	49.9	16.8	0.22	1.0
3a127	Concrete	H	710	2.85	2.24	49.9	18	0.22	1.0
3a119	Concrete	H	45	1.65	1.89	50.0	405	3.3	9.1
3a121	Concrete	H	724	2.86	2.24	50.0	18	0.22	1.0
3a125	Concrete	H	350	2.54	2.24	50.1	18	0.22	1.0
3a123	Concrete	H	450	2.65	2.24	50.1	18	0.22	1.0
3c163	Concrete	H	145	2.16	2.63	50.3	18	0.22	9.1
3a124	Concrete	H	580	2.76	2.24	50.3	18	0.22	1.0
3c162	Concrete	H	5	0.70	1.48	50.5	404	3.3	1.0
3c159	Concrete	H	13	1.11	1.48	50.6	404	3.3	1.0

3c173	Concrete	H	80	1.90	1.48	50.6	403	3.3	1.0
3a122	Concrete	H	650	2.81	2.22	51.0	18	0.22	1.0
3d011	glass	H	122	2.09	2.12	14.9	403	3.3	1.4
3d035	glass	H	240	2.38	2.12	14.9	406	3.3	1.3
3d034	glass	H	680	2.83	2.85	14.9	182	1.5	7.4
3d033	glass	H	343	2.54	2.12	15.1	406	3.3	1.4
3d017	glass	H	520	2.72	2.60	15.1	406	3.3	11.3
3d010	glass	H	655	2.82	2.61	15.1	405	3.3	11.4
3d036	glass	H	700	2.85	2.85	15.2	181	1.5	7.4
3d037	glass	H	980	2.99	2.63	15.2	406	3.3	11.8
3d032	glass	H	725	2.86	2.59	15.3	406	3.3	11.2
3d024	glass	H	1281	3.11	2.86	15.4	18.1	0.22	1.3
3d031	glass	H	500	2.70	2.84	15.5	182	1.5	7.4
3d027	glass	H	1000	3.00	2.85	15.5	182	1.5	7.5
3d023	glass	H	2600	3.41	3.27	15.6	18	0.22	9.8
3d007	glass	H	2912	3.46	3.35	15.8	18	0.22	11.4
3d028	glass	H	303	2.48	2.10	15.9	406	3.3	1.3
3k017	glass	H	53	1.72	2.19	33.9	181	1.5	1.3
3k003	glass	H	175	2.24	2.49	34.2	182	1.5	7.5
3a038	glass	H	740	2.87	2.78	34.2	18.1	0.22	7.1
3c130	glass	H	177	2.25	2.51	34.3	182	1.5	8.0
3c182	glass	H	207	2.32	2.48	34.6	182	1.5	7.5
3k008	glass	H	180	2.26	2.48	34.7	182	1.5	7.5
3c129	glass	H	190	2.28	2.49	34.7	181	1.5	7.7
3c183	glass	H	190	2.28	2.49	34.7	182	1.5	7.8
3k042	glass	H	202	2.31	2.48	34.7	182	1.5	7.5
3a145	glass	H	207	2.32	2.49	34.7	182	1.5	7.8
3k018	glass	H	45	1.65	2.17	34.8	181	1.5	1.3
3a143	glass	H	143	2.16	2.48	34.8	182	1.5	7.7
3a103	glass	H	145	2.16	2.49	34.9	182	1.5	7.8
3a147	glass	H	150	2.18	2.47	34.9	182	1.5	7.4
3a15	glass	H	175	2.24	2.35	34.9	181	1.5	5.1
3c184	glass	H	208	2.32	2.37	34.9	182	1.5	5.4
3k044	glass	H	205	2.31	2.47	35.0	182	1.5	7.4
3c180	glass	H	208	2.32	2.49	35.0	181	1.5	7.8
3a16	glass	H	220	2.34	2.45	35.0	182	1.5	7.0
3c005	glass	H	500	2.70	2.75	35.0	18	0.22	6.9
3c006	glass	H	650	2.81	2.75	35.0	18	0.22	6.9
3a008	glass	H	800	2.90	2.76	35.0	13.9	0.22	6.9
3a66	glass	H	97	1.99	2.16	35.1	182	1.5	1.3
3c145	glass	H	125	2.10	2.05	35.1	405	3.3	7.9
3k001	glass	H	198	2.30	2.47	35.1	181	1.5	7.5
3a003	glass	H	800	2.90	2.75	35.1	15	0.22	6.9
3a004	glass	H	800	2.90	2.76	35.1	14.6	0.22	7.0
3c030	glass	H	220	2.34	2.66	35.1	182	1.5	11.4
3l016	glass	H	52	1.72	2.16	35.2	181	1.5	1.3
3c21	glass	H	89	1.95	2.16	35.2	182	1.5	1.3
3c146	glass	H	177	2.25	2.49	35.2	182	1.5	7.9
3a001	glass	H	800	2.90	2.75	35.2	14.9	0.22	6.9

3a011	glass	H	800	2.90	2.75	35.2	14.1	0.22	7.0
3a009	glass	H	800	2.90	2.75	35.2	14	0.22	6.9
3c135	glass	H	180	2.26	2.48	35.3	182	1.5	7.9
3a076	glass	H	212	2.33	2.64	35.3	182	1.5	11.2
3c075	glass	H	215	2.33	2.65	35.3	161	1.5	11.2
3a010	glass	H	720	2.86	2.75	35.4	14.2	0.22	7.0
3c004	glass	H	618	2.79	2.75	35.6	18	0.22	7.1
3c037	glass	H	230	2.36	2.63	35.7	182	1.5	11.1
3a05	glass	H	225	2.35	2.43	35.8	181	1.5	6.9
3a74	glass	H	95	1.98	2.15	35.9	182	1.5	1.4
3a099	glass	H	167	2.22	2.47	35.9	182	1.5	7.9
3a014	glass	H	725	2.86	2.73	36.1	14	0.22	6.9
3l019	glass	H	44	1.64	2.14	36.5	182	1.5	1.3
3c007	glass	H	410	2.61	2.51	47.6	18	0.22	7.0
3c012	glass	H	405	2.61	2.50	48.2	18	0.22	6.8
3a035	glass	H	376	2.58	2.50	48.3	18	0.22	6.9
3a034	glass	H	377	2.58	2.51	48.3	18	0.22	7.1
3c013	glass	H	376	2.58	2.51	48.4	18	0.22	7.2
3c011	glass	H	431	2.63	2.51	48.4	18	0.22	7.2
3a032	glass	H	315	2.50	2.49	48.5	18	0.22	6.8
3c009	glass	H	457	2.66	2.50	48.6	18	0.22	7.0
3c014	glass	H	367	2.56	2.50	48.6	18	0.22	7.1
3c015	glass	H	325	2.51	2.49	48.8	18	0.22	7.1
3c052	glass	H	50	1.70	1.74	49.7	406	3.3	7.4
3k011	glass	H	73	1.86	2.19	49.7	181	1.5	7.5
3c051	glass	H	74	1.87	2.36	49.7	182	1.5	11.1
3c140	glass	H	97	1.99	2.20	49.7	182	1.5	7.7
3k019	glass	H	15	1.18	1.88	49.8	182	1.5	1.3
3c041	glass	H	23	1.36	1.44	49.8	404	3.3	1.3
3c028	glass	H	75	1.88	2.19	49.8	182	1.5	7.6
3c136	glass	H	73	1.86	2.20	49.9	181	1.5	7.9
3c043	glass	H	21	1.32	1.44	50.0	405	3.3	1.3
3c47	glass	H	33	1.52	1.87	50.0	182	1.5	1.2
3c042	glass	H	55	1.74	1.92	50.0	404	3.3	11.2
3a033	glass	H	315	2.50	2.47	50.0	18	0.22	7.0
3a81	glass	H	39	1.59	1.88	50.1	182	1.5	1.3
3c053	glass	H	53	1.72	1.94	50.1	406	3.3	11.5
3a077	glass	H	74	1.87	2.18	50.1	182	1.5	7.5
3c045	glass	H	81	1.91	2.36	50.1	182	1.5	11.3
3a080	glass	H	69	1.84	2.16	50.3	182	1.5	7.2
3c046	glass	H	80	1.90	2.17	50.5	182	1.5	7.5
3a079	glass	H	81	1.91	2.35	50.7	182	1.5	11.2
3k009	glass	H	72	1.86	2.17	50.9	182	1.5	7.5
3a055	glass	H	185	2.27	2.47	51.1	18	0.22	7.4
3d050	sand	H	3610	3.56	3.54	14.4	18	0.22	8.9
3d046	sand	H	1270	3.10	2.78	14.7	406	3.3	8.7
3d041	sand	H	1310	3.12	3.07	14.7	181	1.5	5.8
3d051	sand	H	950	2.98	3.15	14.8	18	0.22	1.0
3d052	sand	H	4000	3.60	3.54	14.8	18	0.22	8.9

3d054	sand	H	280	2.45	2.39	14.9	405	3.3	1.0
3d042	sand	H	300	2.48	2.39	14.9	405	3.3	1.0
3d030	sand	H	720	2.86	3.14	15.1	18.1	0.22	0.9
3d047	sand	H	1050	3.02	3.14	15.1	18.1	0.22	1.0
3d043	sand	H	1100	3.04	2.77	15.1	406	3.3	8.7
3d044	sand	H	1400	3.15	3.07	15.1	182	1.5	5.8
3d048	sand	H	4100	3.61	3.53	15.1	18	0.22	8.9
3d045	sand	H	300	2.48	2.39	15.2	406	3.3	1.0
3d040	sand	H	1280	3.11	2.77	15.2	406	3.3	8.7
3d029	sand	H	4400	3.64	3.51	15.2	18.1	0.22	8.6
3d053	sand	H	850	2.93	3.14	15.3	18	0.22	1.0
3d056	sand	H	215	2.33	2.63	15.4	405	3.3	6.0
3d055	sand	H	227	2.36	2.38	15.6	405	3.3	1.0
3d039	sand	H	290	2.46	2.38	15.6	405	3.3	1.0
3d049	sand	H	950	2.98	3.08	18.5	18	0.22	1.0
3a113	sand	H	630	2.80	2.78	34.2	182	1.5	7.5
3c100	sand	H	200	2.30	2.46	34.4	182	1.5	1.0
3c098	sand	H	500	2.70	2.70	34.4	182	1.5	6.0
3a093	sand	H	1700	3.23	3.01	34.5	18.1	0.22	6.0
3c080	sand	H	480	2.68	2.68	34.6	181	1.5	5.7
3c113	sand	H	560	2.75	2.69	34.7	182	1.5	6.0
3a112	sand	H	680	2.83	2.70	34.7	181	1.5	6.1
3c110	sand	H	520	2.72	2.69	34.8	182	1.5	6.0
3c085	sand	H	615	2.79	2.69	34.8	182	1.5	5.8
3c079	sand	H	134	2.13	2.45	34.9	181	1.5	1.0
3c095	sand	H	400	2.60	2.25	34.9	404	3.3	6.0
3c111	sand	H	520	2.72	2.69	34.9	182	1.5	6.0
3c097	sand	H	145	2.16	2.45	35.0	182	1.5	1.0
3c096	sand	H	180	2.26	2.45	35.0	182	1.5	1.0
3c099	sand	H	530	2.72	2.69	35.0	182	1.5	6.0
3a132	sand	H	590	2.77	2.69	35.0	182	1.5	6.1
3c083	sand	H	420	2.62	2.68	35.1	182	1.5	5.8
3a131	sand	H	521	2.72	2.69	35.1	182	1.5	6.1
3c112	sand	H	550	2.74	2.69	35.1	182	1.5	6.0
3c114	sand	H	560	2.75	2.69	35.1	182	1.5	6.0
3c078	sand	H	565	2.75	2.82	35.1	181	1.5	8.7
3c084	sand	H	353	2.55	2.24	35.2	405	3.3	5.8
3c086	sand	H	400	2.60	2.24	35.2	405	3.3	5.8
3c082	sand	H	620	2.79	2.82	35.2	182	1.5	8.7
3c081	sand	H	131	2.12	2.44	35.3	181	1.5	1.0
3c154	sand	H	580	2.76	2.69	35.3	181	1.5	6.1
3c093	sand	H	765	2.88	2.82	35.3	182	1.5	8.7
3c103	sand	H	2000	3.30	2.99	35.3	18.1	0.22	6.0
3c101	sand	H	560	2.75	2.68	35.4	181	1.5	6.0
3c106	sand	H	2400	3.38	2.99	35.7	18.1	0.22	6.0
3c109	sand	H	530	2.72	2.57	41.1	182	1.5	6.0
3c102	sand	H	500	2.70	2.48	49.5	18.1	0.22	1.0
3c107	sand	H	620	2.79	2.48	49.5	18.1	0.22	1.0
3c116	sand	H	380	2.58	2.40	49.7	182	1.5	6.0

3c076	sand	H	380	2.58	2.47	49.9	18.1	0.22	1.0
3a115	sand	H	380	2.58	2.40	49.9	182	1.5	6.0
3c075	sand	H	400	2.60	2.47	50.0	18.1	0.22	1.0
3c094	sand	H	1100	3.04	2.11	50.0	404	3.3	9.1
3c092	sand	H	80	1.90	1.71	50.1	405	3.3	1.0
3c088	sand	H	300	2.48	2.09	50.1	405	3.3	8.6
3c089	sand	H	404	2.61	2.39	50.3	182	1.5	5.8
3c090	sand	H	84	1.92	1.71	50.4	404	3.3	1.0
3c118	sand	H	340	2.53	2.39	50.4	182	1.5	6.0
3c091	sand	H	372	2.57	2.39	50.4	181	1.5	6.0
3c117	sand	H	372	2.57	2.39	50.4	182	1.5	6.0
3a126	sand	H	530	2.72	2.46	50.4	18	0.22	1.0
3c087	sand	H	383	2.58	2.38	50.6	182	1.5	5.8
3c108	sand	H	1650	3.22	2.84	50.6	18.1	0.22	8.9
3a160	Concrete	VX	450	2.65	2.74	34.3	405.3	3.3	8.3
3c193	Concrete	VX	145	2.16	2.72	35.5	404.9	3.3	8.3
3c197	Concrete	VX	300	2.48	2.71	35.7	405	3.3	8.3
3c194	Concrete	VX	310	2.49	3.10	36.0	16.4	0.22	0.9
3a158	Concrete	VX	400	2.60	2.91	41.4	181.7	1.5	5.5
3c195	Concrete	VX	650	2.81	2.89	42.3	181.5	1.5	5.5
3a157	Concrete	VX	515	2.71	2.89	42.4	181.5	1.5	5.5
3a159	Concrete	VX	400	2.60	2.88	42.9	181.8	1.5	5.5
3k055	Concrete	VX	1700	3.23	3.24	47.3	19.4	0.22	8.3
3k054	Concrete	VX	87	1.94	2.12	48.0	398.9	3.3	0.9
3k057	Concrete	VX	990	3.00	3.21	49.1	19.4	0.22	8.3
3k053	Concrete	VX	1880	3.27	3.22	49.4	19.4	0.22	8.7
3k056	Concrete	VX	40	1.60	2.09	49.5	406.4	3.3	0.9
3l054	Concrete	VX	1980	3.30	3.20	49.6	19.4	0.22	8.3
3l053	Concrete	VX	138	2.14	2.08	49.7	403.6	3.3	0.9
3l056	Concrete	VX	1500	3.18	3.19	49.7	19.4	0.22	8.3
3l055	Concrete	VX	127	2.10	2.08	49.9	406.1	3.3	0.9
3l052	Concrete	VX	2500	3.40	3.17	50.7	19.3	0.22	8.3
3k022	glass	VX	2500	3.40	2.97	34.5	181.7	1.5	5.5
3a116	glass	VX	850	2.93	2.97	34.6	181.9	1.5	5.5
3l031	glass	VX	2500	3.40	2.66	34.7	405.4	3.3	8.3
3a115	glass	VX	640	2.81	2.74	34.9	181.9	1.5	0.9
3l038	glass	VX	1850	3.27	2.66	34.9	405	3.3	8.3
3c157	glass	VX	1100	3.04	2.73	35.2	181.3	1.5	0.9
3c158	glass	VX	2470	3.39	2.96	35.2	181.3	1.5	5.5
3l039	glass	VX	2000	3.30	3.04	35.3	18.7	0.22	0.9
3k037	glass	VX	2200	3.34	3.04	35.3	18.7	0.22	0.9
3k029	glass	VX	2080	3.32	3.04	35.5	18.8	0.22	0.9
3k039	glass	VX	1950	3.29	2.65	35.6	404.1	3.3	8.3
3l036	glass	VX	2200	3.34	3.03	35.8	18.7	0.22	0.9
3k038	glass	VX	1600	3.20	2.83	42.0	181.6	1.5	5.5
3l037	glass	VX	1650	3.22	2.82	42.2	181.5	1.5	5.5
3k023	glass	VX	267	2.43	2.02	49.6	405.6	3.3	0.9
3k036	glass	VX	1900	3.28	3.13	49.6	18.7	0.22	8.3
3k035	glass	VX	106	2.03	2.01	49.8	406.2	3.3	0.9

3l034	glass	VX	227	2.36	2.01	50.1	405.7	3.3	0.9
3l033	glass	VX	277	2.44	2.01	50.1	405.4	3.3	0.9
3l021	glass	VX	640	2.81	2.37	50.1	405.4	3.3	8.3
3k032	glass	VX	2020	3.31	3.12	50.1	18.8	0.22	8.3
3k025	glass	VX	234	2.37	2.01	50.2	405.6	3.3	0.9
3k034	glass	VX	189	2.28	2.00	50.3	405.6	3.3	0.9
3k024	glass	VX	706	2.85	2.75	50.4	18.7	0.22	0.9
3l022	glass	VX	2440	3.39	3.11	50.5	18.7	0.22	8.3
3k026	glass	VX	730	2.86	2.75	50.6	18.7	0.22	0.9
3l026	glass	VX	2200	3.34	3.11	50.6	18.7	0.22	8.3
3l023	glass	VX	567	2.75	2.36	50.7	405.4	3.3	8.3
3l035	glass	VX	2700	3.43	3.11	50.7	18.7	0.22	8.3
3c187	sand	VX	767	2.88	3.37	33.8	18	0.22	0.9
3a154	sand	VX	860	2.93	2.97	34.3	405.4	3.3	8.3
3a150	sand	VX	420	2.62	3.35	34.6	18.1	0.22	0.9
3l045	sand	VX	450	2.65	3.35	34.6	18.6	0.22	0.9
3a161	sand	VX	4580	3.66	3.71	34.6	18.1	0.22	8.3
3c176	sand	VX	1720	3.24	3.35	34.7	18.1	0.22	0.9
3c177	sand	VX	1034	3.01	3.34	35.0	18.1	0.22	0.9
3a162	sand	VX	6290	3.80	3.70	35.2	18.1	0.22	8.3
3l048	sand	VX	630	2.80	2.94	35.4	405.4	3.3	8.3
3c191	sand	VX	920	2.96	2.93	36.1	404.9	3.3	8.3
3k051	sand	VX	1090	3.04	3.16	39.9	181.8	1.5	5.5
3a151	sand	VX	615	2.79	3.14	40.9	181.2	1.5	5.5
3c179	sand	VX	550	2.74	3.13	41.5	181.4	1.5	5.5
3k048	sand	VX	700	2.85	3.13	41.6	181.8	1.5	5.5
3a153	sand	VX	600	2.78	3.13	41.7	181.6	1.5	5.5
3c188	sand	VX	510	2.71	3.12	41.9	181	1.5	5.5
3l046	sand	VX	750	2.88	3.12	42.1	181.6	1.5	5.5
3l049	sand	VX	775	2.89	3.12	42.1	181.6	1.5	5.5
3k046	sand	VX	510	2.71	3.12	42.2	181.8	1.5	5.5
3c190	sand	VX	680	2.83	3.11	42.3	181.5	1.5	5.5
3k061	sand	VX	556	2.75	2.69	48.4	406.5	3.3	8.3
3k049	sand	VX	108	2.03	2.33	48.8	405.7	3.3	0.9
3c189	sand	VX	2600	3.41	3.44	48.8	16.5	0.22	8.3
3a152	sand	VX	2500	3.40	3.43	48.9	19	0.22	8.3
3k052	sand	VX	2500	3.40	3.43	49.2	18.9	0.22	8.3
3l061	sand	VX	735	2.87	3.06	49.6	19.6	0.22	0.9
3l058	sand	VX	522	2.72	3.06	49.8	19.5	0.22	0.9
3l050	sand	VX	3200	3.51	3.42	49.9	18.7	0.22	8.3
3l051	sand	VX	246	2.39	2.30	50.3	405.5	3.3	0.9
3l047	sand	VX	125	2.10	2.29	50.7	405.4	3.3	0.9

Blank

APPENDIX E

MERCURY INTRUSION POROSIMETRY OF 0.50 BR CONCRETE

Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07	Serial: 454	Port: 3/1	Page 1

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time:	4/19/2007 10:48:00AM	Sample Weight:	3.4464 g
HP Analysis Time:	4/19/2007 12:53:44PM	Correction Type:	None
Report Time:	4/19/2007 12:53:45PM	Show Neg. Int:	No

Summary Report

Penetrometer parameters

Penetrometer:	265 - (01) 15 Bulb, 0.392 Stem, Solid		
Pen. Constant:	10.790 µL/pF	Pen. Weight:	70.4745 g
Stem Volume:	0.3920 mL	Max. Head Pressure:	4.4500 psia
Pen. Volume:	14.9631 mL	Assembly Weight:	255.1012 g

Hg Parameters

Adv. Contact Angle:	130.000 degrees	Rec. Contact Angle:	130.000 degrees
Hg Surface Tension:	485.000 dynes/cm	Hg Density:	13.5335 g/mL

Low Pressure:

Evacuation Pressure:	50 µmHg
Evacuation Time:	5 mins
Mercury Filling Pressure:	0.56 psia
Equilibration Time:	10 secs

High Pressure:

Equilibration Time:	10 secs

No Blank Correction

Intrusion Data Summary

Total Intrusion Volume =	0.0645 mL/g
Total Pore Area =	10.924 m²/g
Median Pore Diameter (Volume) =	0.2516 µm
Median Pore Diameter (Area) =	0.0046 µm
Average Pore Diameter (4V/A) =	0.0236 µm
Bulk Density at 0.56 psia =	2.1874 g/mL
Apparent (skeletal) Density =	2.5469 g/mL
Porosity =	14.1140 %
Stem Volume Used =	57 %

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 Serial: 454 Port: 3/1

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (µm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
0.56	322.6523	0.0000	0.0000	0.000	0.000
0.80	227.1878	0.0016	0.0016	0.000	0.000
1.05	172.9999	0.0021	0.0006	0.000	0.000
2.03	89.2315	0.0033	0.0012	0.000	0.000
3.03	59.7631	0.0037	0.0003	0.000	0.000
4.03	44.9335	0.0039	0.0003	0.000	0.000
5.52	32.7537	0.0043	0.0003	0.000	0.000
7.02	25.7755	0.0044	0.0002	0.000	0.000
8.51	21.2562	0.0046	0.0002	0.000	0.000
10.50	17.2222	0.0048	0.0002	0.000	0.000
13.00	13.9154	0.0064	0.0016	0.001	0.000
15.99	11.3140	0.0066	0.0002	0.001	0.000
19.97	9.0585	0.0069	0.0003	0.001	0.000
23.00	7.8628	0.0070	0.0002	0.001	0.000
25.01	7.2323	0.0072	0.0002	0.001	0.000
29.97	6.0346	0.0076	0.0004	0.001	0.000
36.94	4.8958	0.0079	0.0003	0.001	0.000
46.83	3.8623	0.0082	0.0004	0.002	0.000
56.75	3.1868	0.0090	0.0008	0.003	0.001
71.94	2.5142	0.0100	0.0010	0.004	0.001
87.06	2.0775	0.0108	0.0008	0.005	0.001
112.21	1.6118	0.0125	0.0017	0.009	0.004
137.59	1.3145	0.0142	0.0017	0.014	0.005
172.87	1.0462	0.0169	0.0027	0.023	0.009
217.63	0.8311	0.0202	0.0033	0.037	0.014
267.02	0.6773	0.0235	0.0033	0.054	0.017
328.07	0.5513	0.0262	0.0027	0.072	0.018
418.50	0.4322	0.0289	0.0026	0.093	0.021
517.31	0.3496	0.0305	0.0017	0.111	0.017
637.67	0.2836	0.0317	0.0011	0.125	0.014
697.54	0.2593	0.0321	0.0005	0.132	0.007
797.01	0.2269	0.0328	0.0006	0.142	0.011
989.11	0.1829	0.0338	0.0011	0.163	0.021
1198.26	0.1509	0.0350	0.0011	0.190	0.027
1297.76	0.1394	0.0355	0.0006	0.206	0.016
1397.44	0.1294	0.0361	0.0006	0.223	0.018
1497.29	0.1208	0.0367	0.0006	0.243	0.019
1596.80	0.1133	0.0373	0.0006	0.264	0.021
1695.79	0.1067	0.0380	0.0006	0.286	0.023

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m^2/g)	Incremental Pore Area (m^2/g)
1896.64	0.0954	0.0393	0.0013	0.338	0.052
2044.77	0.0885	0.0403	0.0010	0.382	0.044
2196.36	0.0823	0.0413	0.0010	0.428	0.046
2346.56	0.0771	0.0422	0.0009	0.474	0.046
2494.78	0.0725	0.0430	0.0008	0.516	0.042
2646.10	0.0684	0.0437	0.0008	0.559	0.043
2695.02	0.0671	0.0439	0.0002	0.571	0.012
2843.06	0.0636	0.0445	0.0006	0.608	0.037
2995.07	0.0604	0.0451	0.0006	0.644	0.036
3246.35	0.0557	0.0458	0.0007	0.695	0.051
3490.47	0.0518	0.0464	0.0006	0.740	0.045
3740.03	0.0484	0.0469	0.0005	0.781	0.041
3987.04	0.0454	0.0473	0.0004	0.816	0.035
4237.85	0.0427	0.0477	0.0004	0.851	0.035
4483.65	0.0403	0.0480	0.0003	0.881	0.030
4720.55	0.0383	0.0483	0.0003	0.909	0.028
4981.40	0.0363	0.0486	0.0003	0.939	0.030
5279.67	0.0343	0.0489	0.0003	0.973	0.033
5479.36	0.0330	0.0491	0.0002	0.993	0.020
5732.75	0.0315	0.0493	0.0003	1.024	0.031
5980.85	0.0302	0.0495	0.0002	1.047	0.023
6231.68	0.0290	0.0497	0.0002	1.073	0.026
6481.31	0.0279	0.0499	0.0002	1.097	0.024
6730.46	0.0269	0.0500	0.0002	1.120	0.023
6980.57	0.0259	0.0502	0.0001	1.142	0.022
7480.57	0.0242	0.0505	0.0003	1.191	0.049
7982.39	0.0227	0.0507	0.0002	1.223	0.032
8483.32	0.0213	0.0509	0.0003	1.276	0.053
8981.90	0.0201	0.0512	0.0002	1.321	0.044
9280.43	0.0195	0.0513	0.0001	1.348	0.027
9576.56	0.0189	0.0515	0.0001	1.378	0.030
10031.31	0.0180	0.0516	0.0002	1.413	0.035
10479.92	0.0173	0.0518	0.0002	1.456	0.043
10984.13	0.0165	0.0520	0.0002	1.502	0.046
11482.38	0.0158	0.0522	0.0002	1.554	0.052
11981.64	0.0151	0.0524	0.0001	1.591	0.037
12581.84	0.0144	0.0526	0.0002	1.644	0.053
13079.43	0.0138	0.0527	0.0002	1.698	0.054
13630.80	0.0133	0.0530	0.0002	1.761	0.062

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
13975.04	0.0129	0.0532	0.0002	1.826	0.065
14318.94	0.0126	0.0532	0.0000	1.831	0.005
14574.81	0.0124	0.0532	0.0001	1.852	0.021
14976.76	0.0121	0.0534	0.0002	1.906	0.054
15430.76	0.0117	0.0536	0.0002	1.958	0.052
15777.09	0.0115	0.0537	0.0001	2.007	0.049
16178.33	0.0112	0.0538	0.0001	2.050	0.043
16626.03	0.0109	0.0540	0.0001	2.103	0.053
16975.99	0.0107	0.0541	0.0001	2.146	0.044
17326.31	0.0104	0.0542	0.0001	2.193	0.046
17675.81	0.0102	0.0544	0.0001	2.246	0.053
18076.29	0.0100	0.0546	0.0002	2.335	0.089
18424.28	0.0098	0.0546	0.0001	2.357	0.023
18771.13	0.0096	0.0547	0.0000	2.367	0.010
19174.91	0.0094	0.0547	0.0000	2.369	0.002
19779.97	0.0091	0.0549	0.0003	2.491	0.122
20278.16	0.0089	0.0551	0.0001	2.553	0.062
20781.61	0.0087	0.0552	0.0002	2.623	0.069
21183.03	0.0085	0.0553	0.0001	2.659	0.036
21636.00	0.0084	0.0555	0.0002	2.735	0.076
22036.71	0.0082	0.0556	0.0001	2.795	0.060
22638.23	0.0080	0.0558	0.0002	2.870	0.075
23189.86	0.0078	0.0559	0.0001	2.919	0.049
23740.49	0.0076	0.0560	0.0002	3.002	0.084
24089.81	0.0075	0.0561	0.0001	3.056	0.053
24641.25	0.0073	0.0562	0.0001	3.128	0.072
25042.14	0.0072	0.0564	0.0001	3.186	0.059
25441.67	0.0071	0.0566	0.0002	3.324	0.138
25891.68	0.0070	0.0568	0.0002	3.425	0.101
26442.27	0.0068	0.0568	-0.0000	3.425	-0.000
26942.78	0.0067	0.0569	0.0001	3.480	0.055
27393.43	0.0066	0.0569	0.0000	3.494	0.014
27793.48	0.0065	0.0569	0.0000	3.514	0.020
28243.88	0.0064	0.0570	0.0001	3.573	0.058
28994.18	0.0062	0.0572	0.0002	3.700	0.127
29494.43	0.0061	0.0574	0.0002	3.798	0.099
29994.22	0.0060	0.0575	0.0001	3.883	0.084
30443.48	0.0059	0.0576	0.0001	3.964	0.081
30893.01	0.0059	0.0577	0.0001	4.042	0.078

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 Serial: 454 Port: 3/1

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
31293.08	0.0058	0.0578	0.0001	4.089	0.047
31792.90	0.0057	0.0580	0.0001	4.191	0.102
32346.05	0.0056	0.0581	0.0001	4.286	0.095
32895.15	0.0055	0.0582	0.0001	4.360	0.075
33492.95	0.0054	0.0584	0.0002	4.482	0.122
33995.59	0.0053	0.0585	0.0001	4.591	0.109
34643.56	0.0052	0.0586	0.0001	4.655	0.063
35494.77	0.0051	0.0588	0.0002	4.805	0.150
36194.57	0.0050	0.0589	0.0001	4.909	0.105
36995.11	0.0049	0.0592	0.0002	5.104	0.194
37643.76	0.0048	0.0593	0.0001	5.192	0.088
38441.59	0.0047	0.0594	0.0001	5.277	0.084
39194.03	0.0046	0.0595	0.0002	5.411	0.134
39995.18	0.0045	0.0597	0.0002	5.603	0.193
40494.72	0.0045	0.0599	0.0001	5.732	0.129
40989.43	0.0044	0.0600	0.0001	5.839	0.107
42488.88	0.0043	0.0603	0.0003	6.100	0.261
43344.51	0.0042	0.0605	0.0002	6.309	0.209
43990.50	0.0041	0.0607	0.0002	6.493	0.184
44990.45	0.0040	0.0609	0.0002	6.727	0.234
46489.05	0.0039	0.0610	0.0001	6.835	0.108
47987.02	0.0038	0.0615	0.0004	7.277	0.442
49482.58	0.0037	0.0618	0.0003	7.630	0.353
50177.82	0.0036	0.0621	0.0003	7.984	0.354
52976.47	0.0034	0.0627	0.0005	8.604	0.620
54474.43	0.0033	0.0631	0.0005	9.143	0.539
55972.29	0.0032	0.0635	0.0004	9.668	0.525
57972.61	0.0031	0.0642	0.0006	10.448	0.780
59972.16	0.0030	0.0645	0.0004	10.924	0.476

Micromeritics Instrument Corporation

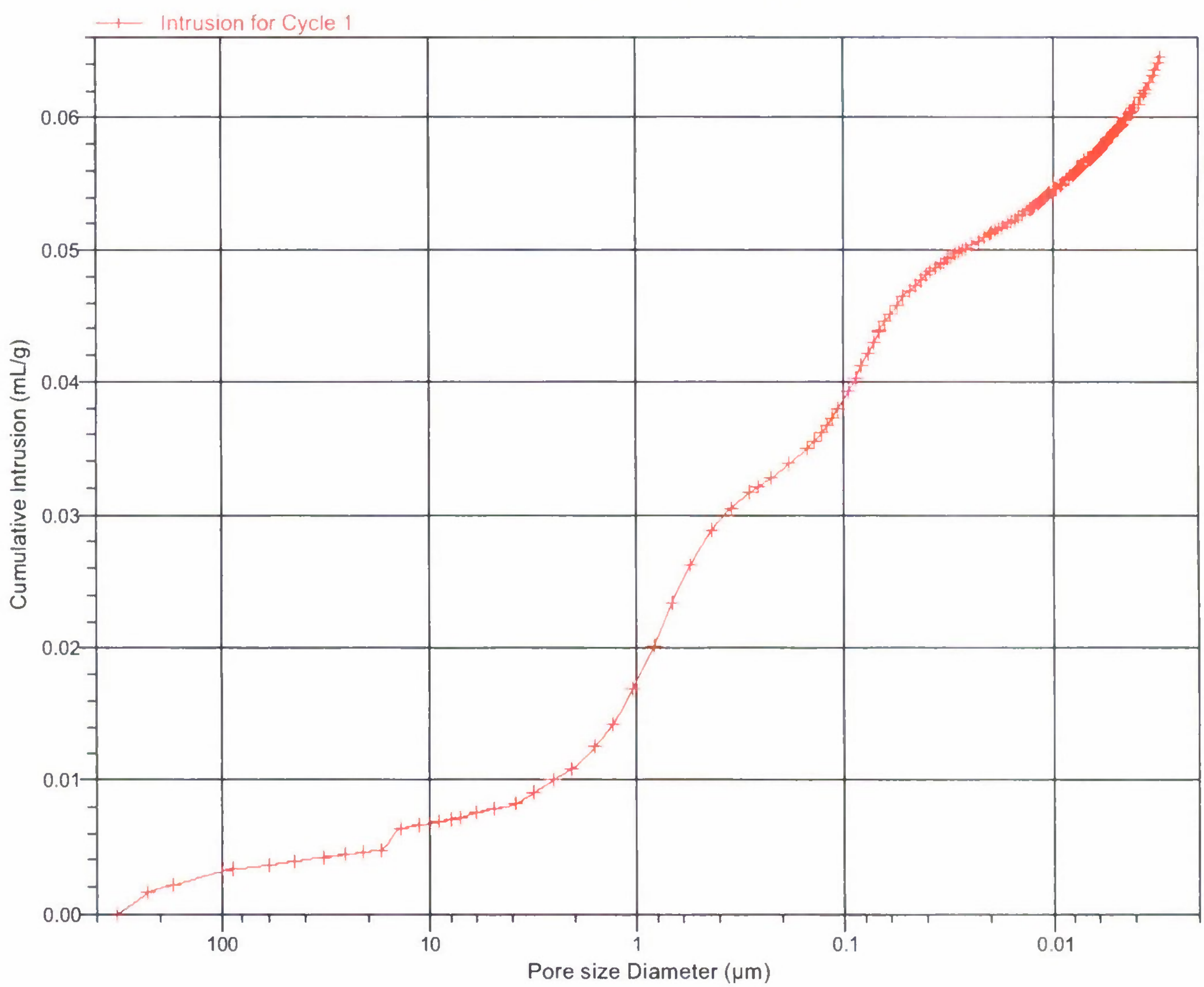
AutoPore IV 9500 V1.07 | Serial: 454 | Port: 3/1 |

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Cumulative Intrusion vs Pore size



MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

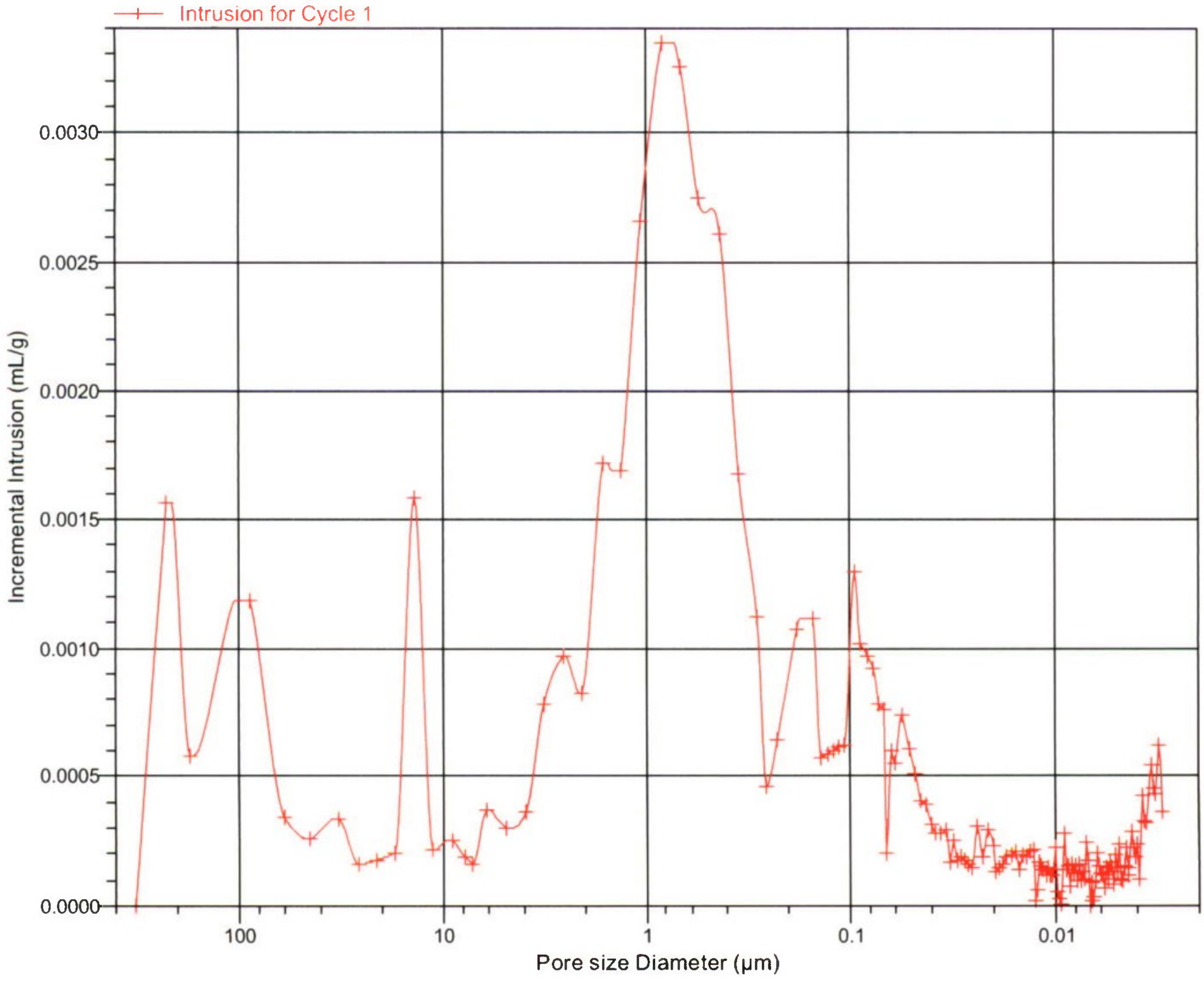
Micromeritics Instrument Corporation

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Incremental Intrusion vs Pore size



Micromeritics Instrument Corporation

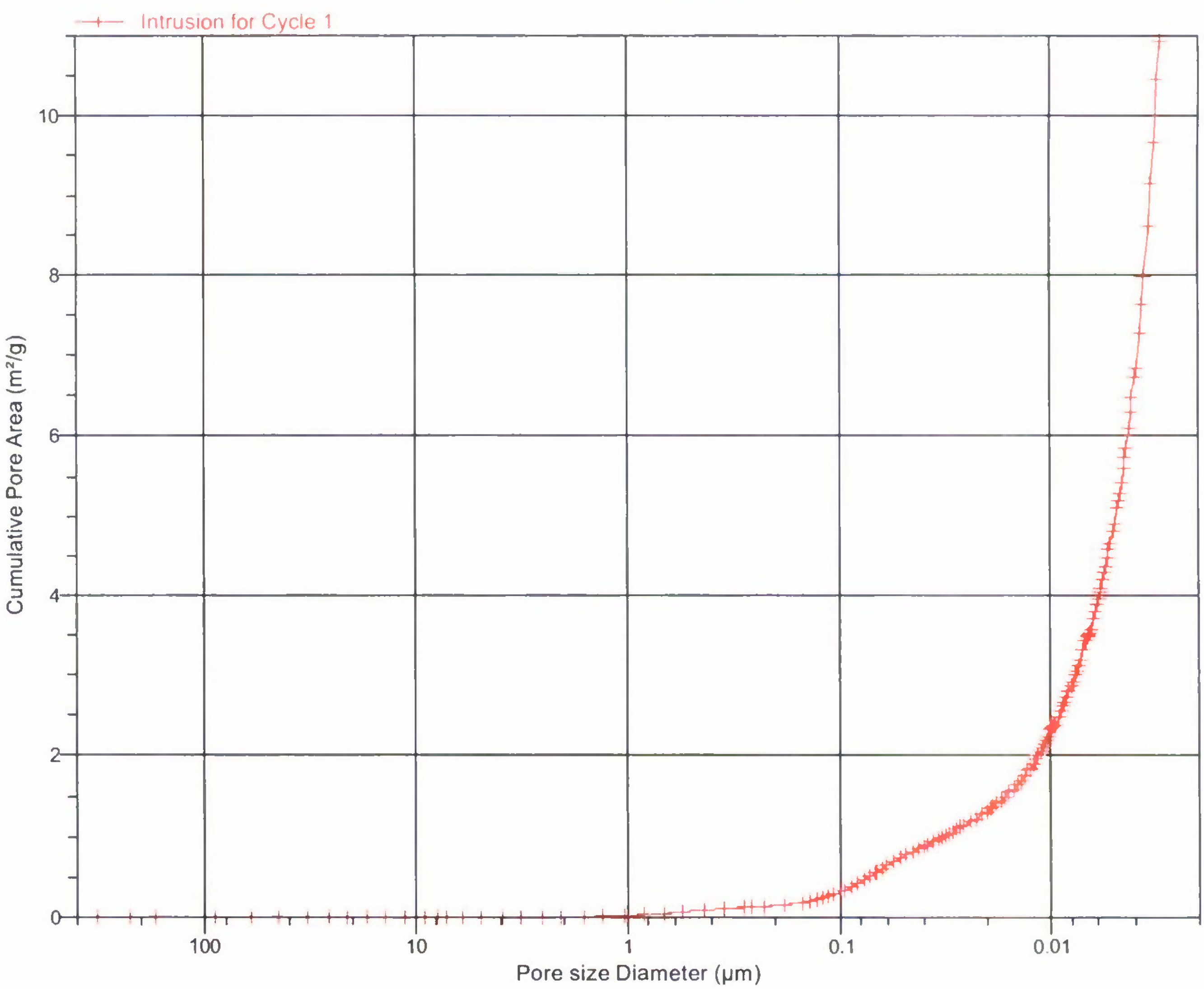
AutoPore IV 9500 V1.07 | Serial: 454 | Port: 3/1 |

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Cumulative Pore Area vs Pore size



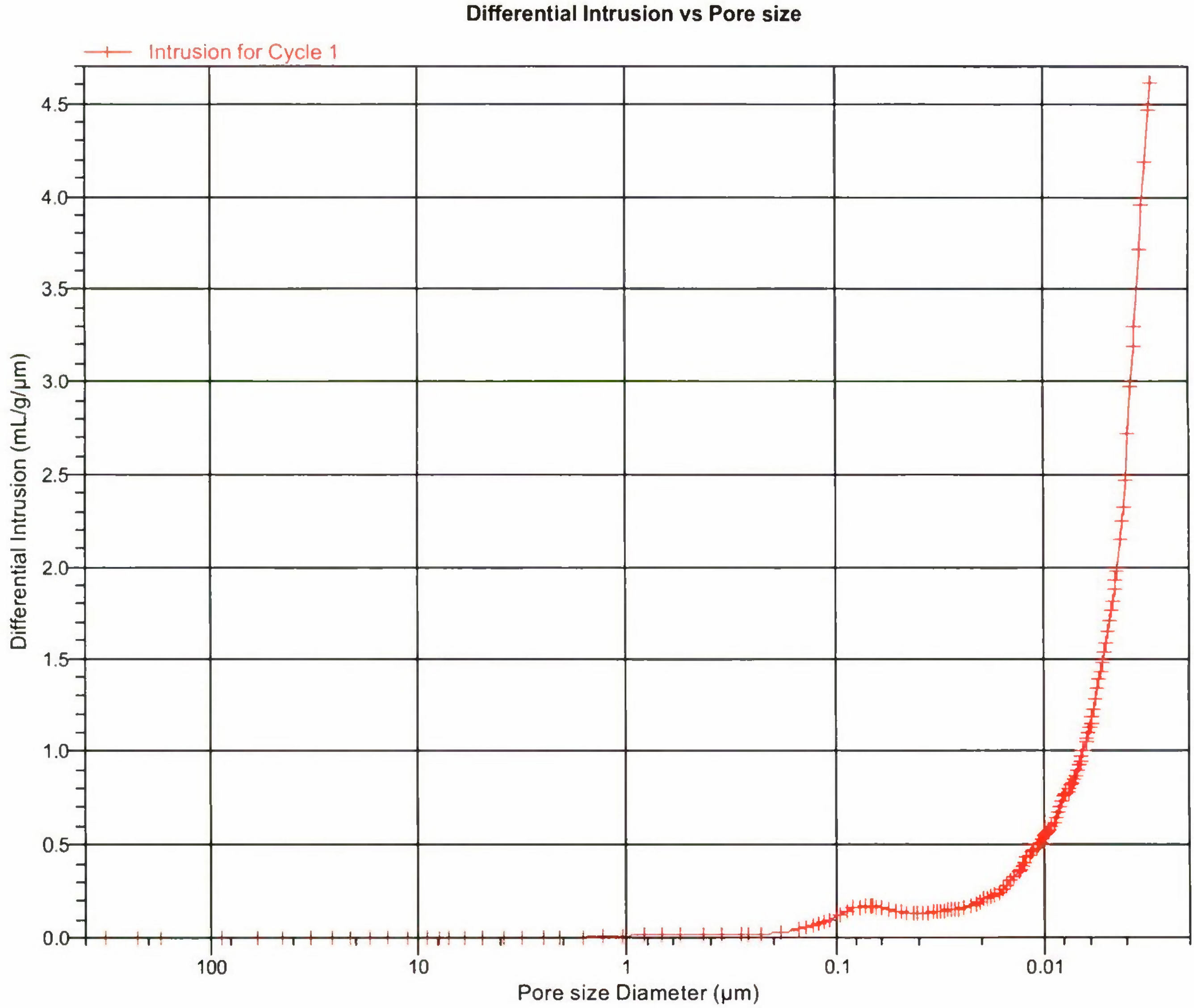
Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 | Serial: 454 | Port: 3/1 | Page 9

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No



MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

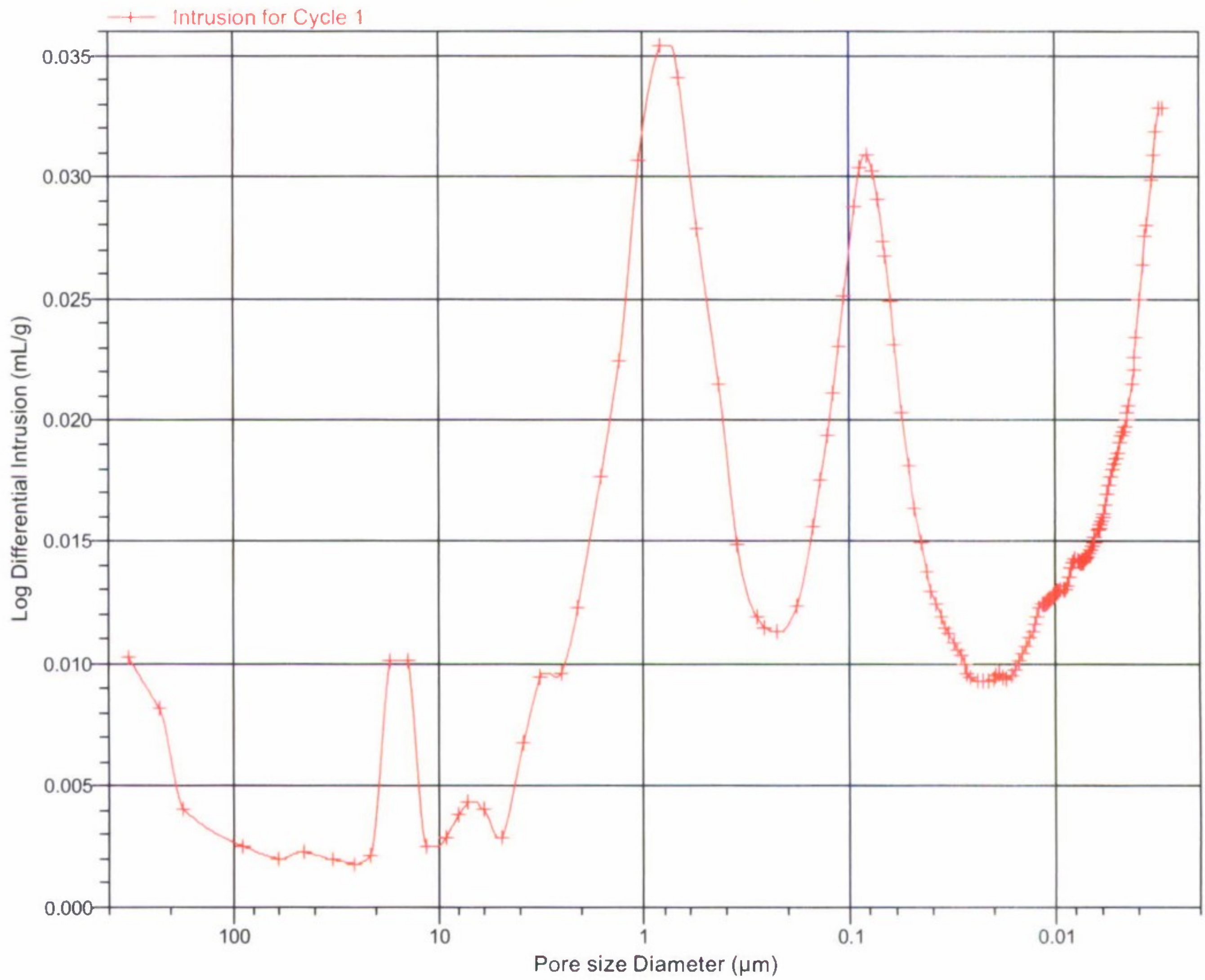
AutoPore IV 9500 V1.07 Serial: 454 Port: 3/1 Page 10

Sample: C 0.5 24Mar05Br 1199-3-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1199A.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 12:53:44PM
Report Time: 4/19/2007 12:53:45PM

Sample Weight: 3.4464 g
Correction Type: None
Show Neg. Int: No

Log Differential Intrusion vs Pore size



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APPENDIX F

MERCURY INTRUSION POROSIMETRY OF 0.45 BR CONCRETE

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07	Serial: 454	Port: 2/2	Page 1

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time:	4/19/2007 10:48:00AM	Sample Weight:	2.1876 g
HP Analysis Time:	4/19/2007 11:50:14AM	Correction Type:	None
Report Time:	4/19/2007 11:50:16AM	Show Neg. Int:	No

Summary Report

Penetrometer parameters

Penetrometer:	918 - (07) 5 Bulb, 0.392 Stem, Solid		
Pen. Constant:	11.117 µL/pF	Pen. Weight:	57.0671 g
Stem Volume:	0.3920 mL	Max. Head Pressure:	4.4500 psia
Pen. Volume:	5.8839 mL	Assembly Weight:	124.6568 g

Hg Parameters

Adv. Contact Angle:	130.000 degrees	Rec. Contact Angle:	130.000 degrees
Hg Surface Tension:	485.000 dynes/cm	Hg Density:	13.5335 g/mL

Low Pressure:

Evacuation Pressure:	50 µmHg
Evacuation Time:	5 mins
Mercury Filling Pressure:	0.56 psia
Equilibration Time:	10 secs

High Pressure:

Equilibration Time:	10 secs

No Blank Correction

Intrusion Data Summary

Total Intrusion Volume =	0.0727 mL/g
Total Pore Area =	7.602 m²/g
Median Pore Diameter (Volume) =	0.4334 µm
Median Pore Diameter (Area) =	0.0052 µm
Average Pore Diameter (4V/A) =	0.0382 µm
Bulk Density at 0.56 psia =	2.0809 g/mL
Apparent (skeletal) Density =	2.4517 g/mL
Porosity =	15.1246 %
Stem Volume Used =	41 %

Micromeritics Instrument Corporation

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m^2/g)	Incremental Pore Area (m^2/g)
0.56	322.6523	0.0000	0.0000	0.000	0.000
0.80	227.1878	0.0016	0.0016	0.000	0.000
1.05	172.9999	0.0023	0.0007	0.000	0.000
2.03	89.2315	0.0040	0.0016	0.000	0.000
3.03	59.7631	0.0045	0.0006	0.000	0.000
4.03	44.9335	0.0048	0.0003	0.000	0.000
5.52	32.7537	0.0054	0.0006	0.000	0.000
7.02	25.7755	0.0060	0.0006	0.000	0.000
8.51	21.2562	0.0064	0.0003	0.000	0.000
10.50	17.2222	0.0067	0.0003	0.000	0.000
13.00	13.9154	0.0071	0.0004	0.001	0.000
15.99	11.3140	0.0074	0.0003	0.001	0.000
19.97	9.0585	0.0077	0.0003	0.001	0.000
23.00	7.8628	0.0080	0.0003	0.001	0.000
25.01	7.2323	0.0083	0.0002	0.001	0.000
29.97	6.0346	0.0087	0.0004	0.001	0.000
38.92	4.6475	0.0088	0.0002	0.001	0.000
48.84	3.7031	0.0096	0.0008	0.002	0.001
59.14	3.0582	0.0106	0.0010	0.003	0.001
74.01	2.4438	0.0117	0.0011	0.005	0.002
88.21	2.0503	0.0129	0.0011	0.007	0.002
113.52	1.5932	0.0152	0.0024	0.012	0.005
139.23	1.2991	0.0180	0.0027	0.020	0.008
173.08	1.0449	0.0205	0.0025	0.028	0.009
217.65	0.8310	0.0245	0.0041	0.046	0.017
268.27	0.6742	0.0292	0.0046	0.070	0.025
327.77	0.5518	0.0330	0.0038	0.095	0.025
418.58	0.4321	0.0364	0.0034	0.123	0.028
518.71	0.3487	0.0384	0.0020	0.143	0.020
640.56	0.2824	0.0398	0.0015	0.162	0.019
698.30	0.2590	0.0404	0.0006	0.170	0.008
799.92	0.2261	0.0412	0.0008	0.183	0.013
987.98	0.1831	0.0425	0.0013	0.209	0.026
1198.59	0.1509	0.0439	0.0014	0.242	0.033
1299.17	0.1392	0.0446	0.0007	0.262	0.019
1398.31	0.1293	0.0454	0.0007	0.284	0.022
1499.19	0.1206	0.0461	0.0007	0.307	0.024
1598.49	0.1131	0.0469	0.0008	0.333	0.026
1697.36	0.1066	0.0476	0.0008	0.362	0.029

Micromeritics Instrument Corporation

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
1897.58	0.0953	0.0492	0.0016	0.424	0.062
2046.69	0.0884	0.0504	0.0012	0.475	0.051
2197.60	0.0823	0.0515	0.0011	0.528	0.053
2347.02	0.0771	0.0526	0.0011	0.581	0.053
2497.41	0.0724	0.0535	0.0010	0.632	0.051
2648.32	0.0683	0.0544	0.0009	0.682	0.050
2696.62	0.0671	0.0547	0.0003	0.699	0.017
2845.65	0.0636	0.0555	0.0008	0.747	0.048
2989.70	0.0605	0.0561	0.0007	0.790	0.043
3242.90	0.0558	0.0572	0.0010	0.860	0.070
3490.58	0.0518	0.0580	0.0008	0.921	0.061
3740.28	0.0484	0.0587	0.0007	0.977	0.056
3990.77	0.0453	0.0593	0.0006	1.028	0.050
4239.45	0.0427	0.0598	0.0005	1.074	0.046
4483.47	0.0403	0.0602	0.0004	1.115	0.041
4723.05	0.0383	0.0606	0.0004	1.152	0.037
4983.05	0.0363	0.0609	0.0004	1.191	0.039
5286.29	0.0342	0.0613	0.0004	1.232	0.042
5483.90	0.0330	0.0615	0.0002	1.259	0.026
5731.65	0.0316	0.0618	0.0002	1.289	0.031
5979.98	0.0302	0.0620	0.0002	1.320	0.030
6233.62	0.0290	0.0622	0.0002	1.350	0.030
6483.94	0.0279	0.0624	0.0002	1.379	0.029
6730.65	0.0269	0.0626	0.0002	1.408	0.029
6981.22	0.0259	0.0628	0.0002	1.437	0.029
7486.24	0.0242	0.0631	0.0003	1.488	0.051
7984.04	0.0227	0.0634	0.0003	1.538	0.049
8484.73	0.0213	0.0637	0.0003	1.586	0.049
8984.73	0.0201	0.0639	0.0002	1.633	0.046
9279.64	0.0195	0.0641	0.0001	1.662	0.029
9580.12	0.0189	0.0642	0.0001	1.692	0.030
10031.77	0.0180	0.0644	0.0002	1.732	0.040
10483.40	0.0173	0.0646	0.0002	1.775	0.043
10984.12	0.0165	0.0648	0.0002	1.821	0.045
11479.71	0.0158	0.0650	0.0002	1.867	0.047
11983.13	0.0151	0.0652	0.0002	1.913	0.046
12582.11	0.0144	0.0653	0.0002	1.965	0.051
13080.83	0.0138	0.0655	0.0002	2.010	0.046
13630.48	0.0133	0.0657	0.0002	2.055	0.045

Micromeritics Instrument Corporation

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (µm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m^2/g)	Incremental Pore Area (m^2/g)
13977.01	0.0129	0.0658	0.0001	2.088	0.033
14318.49	0.0126	0.0659	0.0001	2.127	0.038
14576.43	0.0124	0.0660	0.0001	2.156	0.029
14977.31	0.0121	0.0661	0.0001	2.190	0.034
15427.38	0.0117	0.0662	0.0001	2.232	0.041
15770.48	0.0115	0.0663	0.0001	2.264	0.032
16178.73	0.0112	0.0664	0.0001	2.302	0.038
16628.46	0.0109	0.0665	0.0001	2.334	0.032
16974.04	0.0107	0.0666	0.0001	2.362	0.028
17326.38	0.0104	0.0667	0.0001	2.391	0.029
17677.15	0.0102	0.0667	0.0001	2.421	0.030
18075.64	0.0100	0.0668	0.0001	2.452	0.031
18425.04	0.0098	0.0669	0.0001	2.483	0.031
18774.84	0.0096	0.0670	0.0001	2.514	0.031
19175.25	0.0094	0.0670	0.0001	2.545	0.032
19778.65	0.0091	0.0671	0.0001	2.590	0.044
20278.08	0.0089	0.0672	0.0001	2.631	0.041
20782.57	0.0087	0.0673	0.0001	2.670	0.039
21185.12	0.0085	0.0674	0.0001	2.702	0.032
21636.03	0.0084	0.0675	0.0001	2.738	0.037
22037.28	0.0082	0.0675	0.0001	2.772	0.034
22639.29	0.0080	0.0676	0.0001	2.819	0.047
23190.50	0.0078	0.0677	0.0001	2.848	0.029
23740.52	0.0076	0.0677	0.0001	2.874	0.026
24091.48	0.0075	0.0678	0.0001	2.907	0.032
24642.33	0.0073	0.0679	0.0001	2.951	0.044
25042.10	0.0072	0.0679	0.0001	2.982	0.031
25442.68	0.0071	0.0680	0.0001	3.015	0.033
25894.04	0.0070	0.0681	0.0001	3.049	0.034
26442.79	0.0068	0.0681	0.0001	3.089	0.040
26944.26	0.0067	0.0682	0.0001	3.127	0.038
27394.02	0.0066	0.0682	0.0001	3.164	0.036
27794.76	0.0065	0.0683	0.0001	3.198	0.035
28244.13	0.0064	0.0684	0.0001	3.236	0.038
28995.04	0.0062	0.0684	0.0001	3.286	0.050
29495.21	0.0061	0.0685	0.0001	3.330	0.044
29995.91	0.0060	0.0686	0.0001	3.363	0.033
30445.51	0.0059	0.0686	0.0001	3.402	0.039
30895.26	0.0059	0.0687	0.0001	3.442	0.040

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No

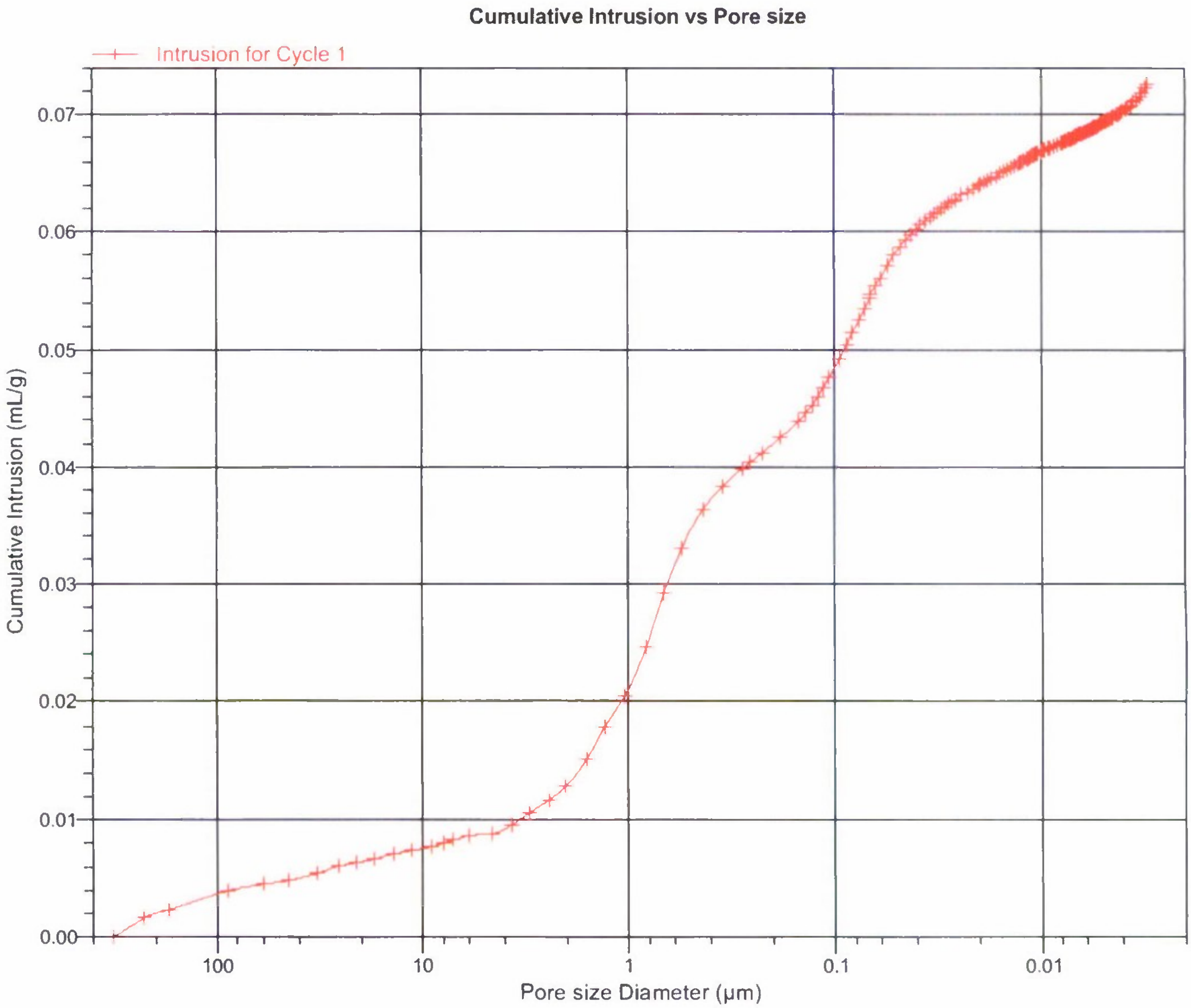
Tabular Report

Pressure (psia)	Pore Diameter (µm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
31295.21	0.0058	0.0687	0.0001	3.482	0.040
31795.29	0.0057	0.0688	0.0001	3.527	0.045
32344.74	0.0056	0.0689	0.0001	3.569	0.042
32895.43	0.0055	0.0689	0.0001	3.620	0.050
33496.32	0.0054	0.0690	0.0001	3.664	0.044
33995.10	0.0053	0.0691	0.0001	3.711	0.047
34646.27	0.0052	0.0691	0.0001	3.770	0.059
35496.03	0.0051	0.0692	0.0001	3.847	0.076
36195.69	0.0050	0.0693	0.0001	3.893	0.047
36995.58	0.0049	0.0694	0.0001	3.960	0.067
37645.49	0.0048	0.0695	0.0001	4.028	0.068
38446.21	0.0047	0.0695	0.0001	4.101	0.073
39195.93	0.0046	0.0696	0.0001	4.183	0.083
39985.82	0.0045	0.0697	0.0001	4.256	0.073
40495.68	0.0045	0.0698	0.0001	4.330	0.074
40994.95	0.0044	0.0699	0.0001	4.399	0.069
42489.82	0.0043	0.0700	0.0001	4.506	0.107
43332.98	0.0042	0.0701	0.0001	4.621	0.115
43992.61	0.0041	0.0702	0.0001	4.722	0.101
44990.48	0.0040	0.0704	0.0001	4.867	0.144
46488.96	0.0039	0.0705	0.0001	4.971	0.104
47987.32	0.0038	0.0707	0.0002	5.186	0.215
49481.80	0.0037	0.0709	0.0002	5.381	0.196
50178.55	0.0036	0.0710	0.0002	5.583	0.202
52977.22	0.0034	0.0713	0.0003	5.912	0.329
54475.38	0.0033	0.0716	0.0003	6.226	0.314
55974.05	0.0032	0.0719	0.0003	6.600	0.374
57974.55	0.0031	0.0723	0.0004	7.063	0.463
59973.02	0.0030	0.0727	0.0004	7.602	0.539

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No



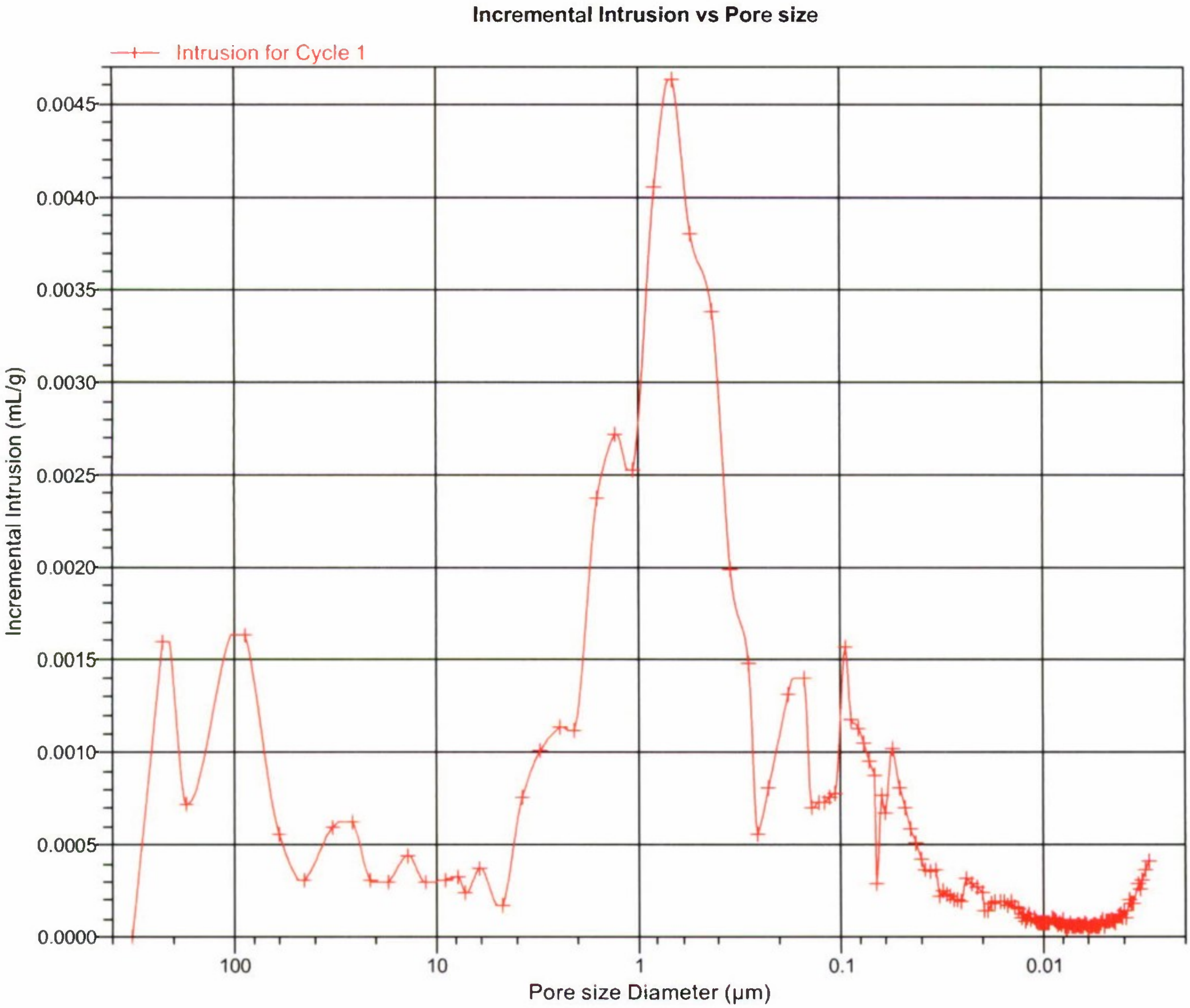
Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 Serial: 454 Port: 2/2 Page 7

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No



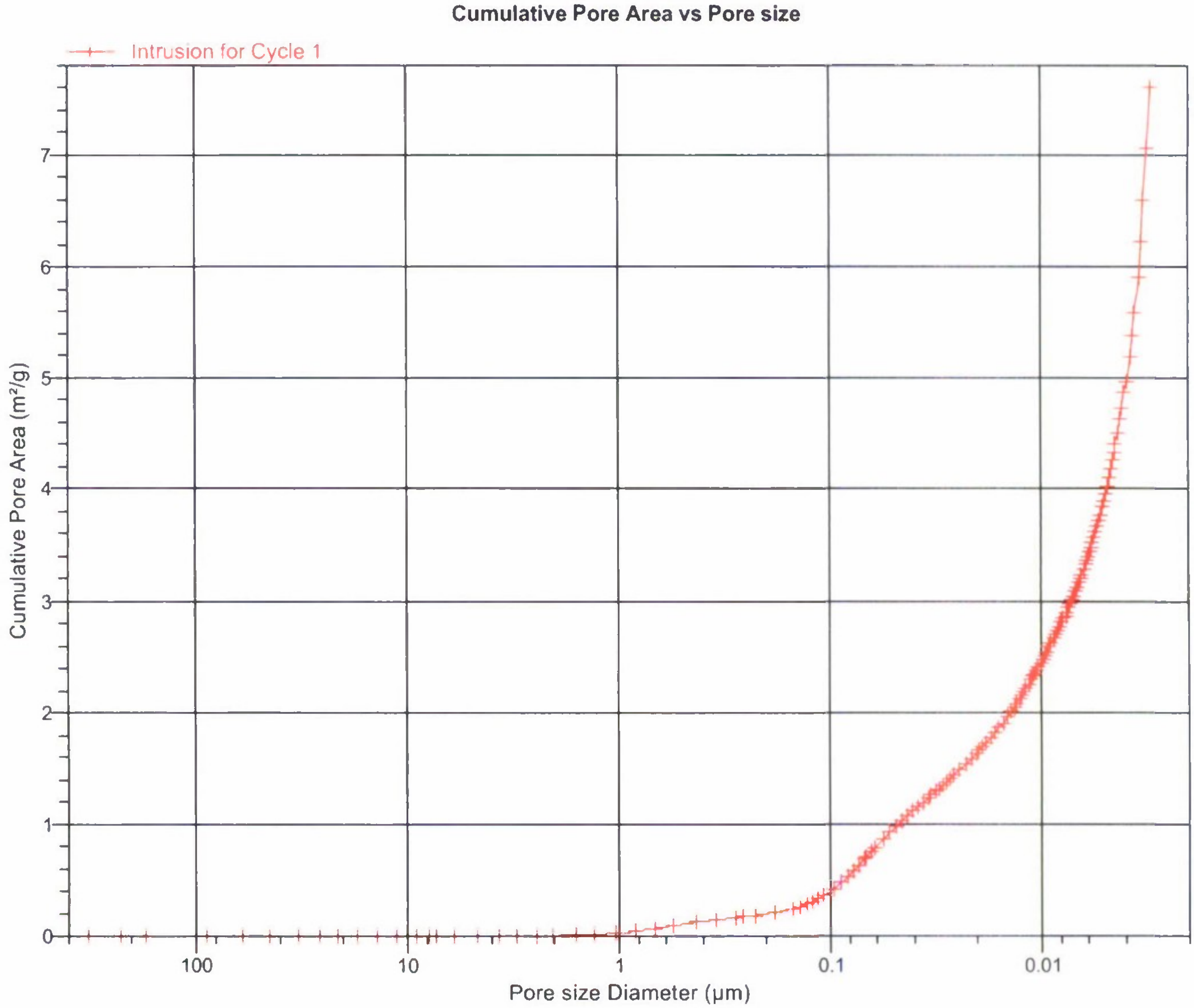
Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 Serial: 454 Port: 2/2 Page 8

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:16AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No



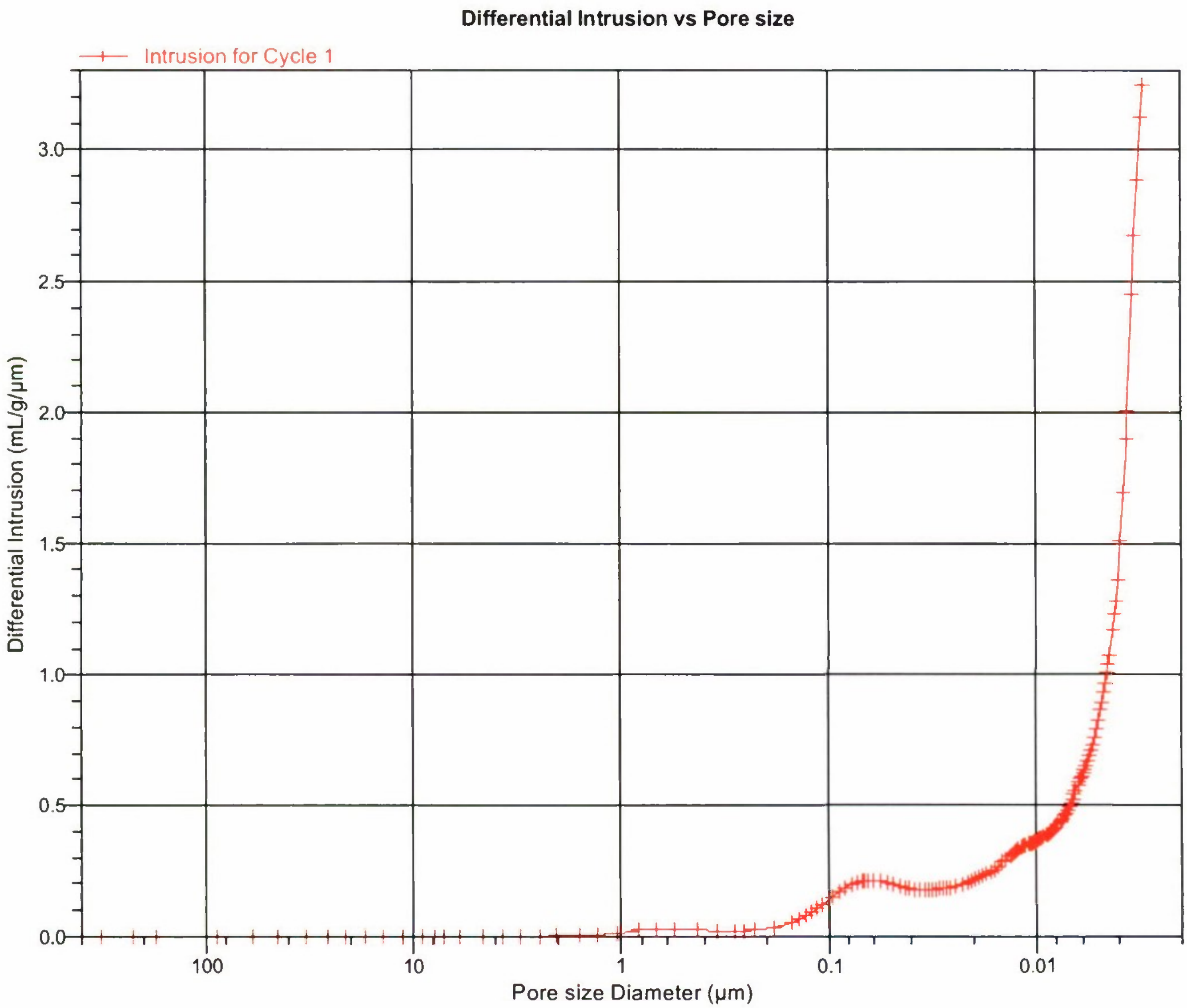
Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 Serial: 454 Port: 2/2 Page 9

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:17AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No

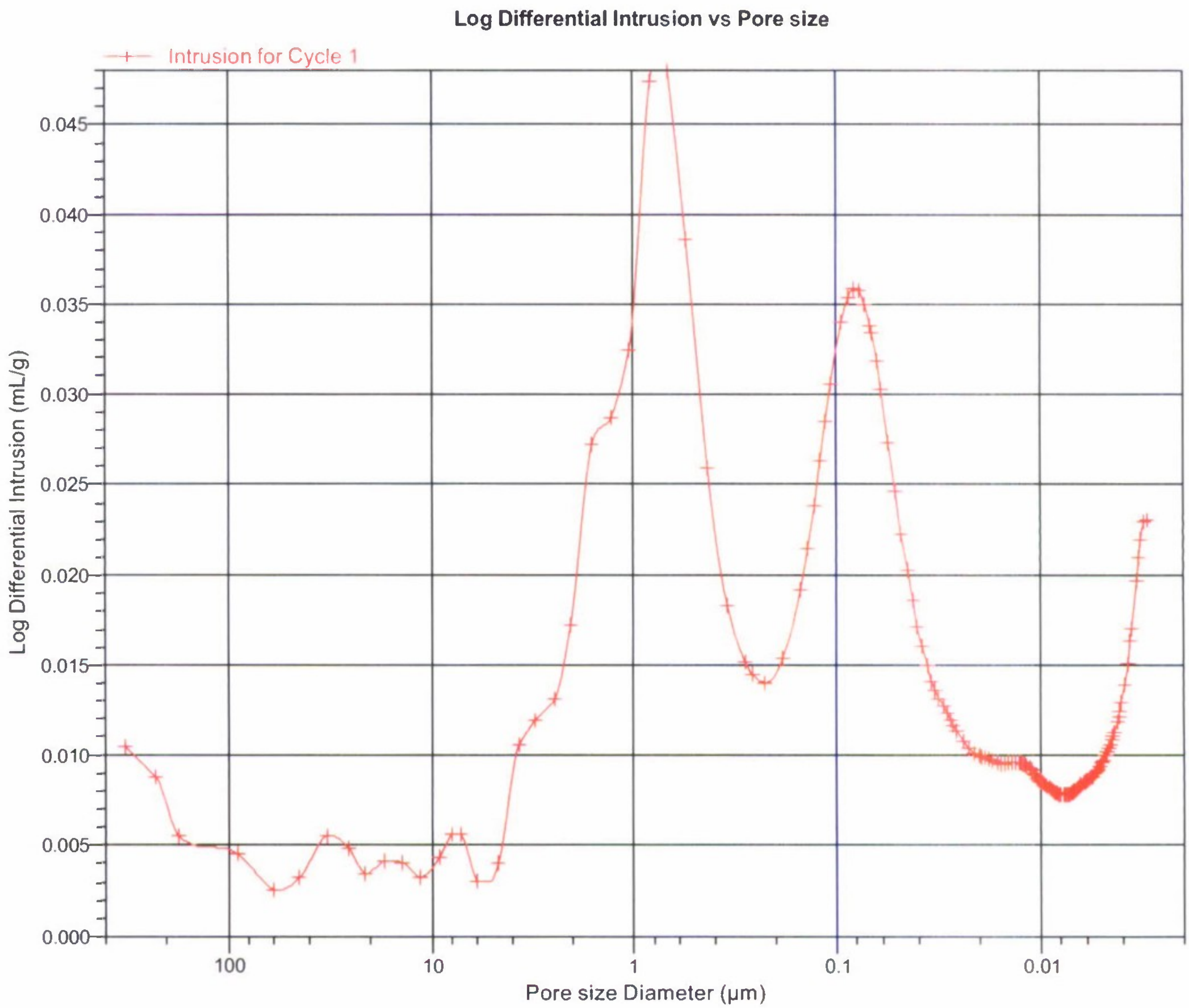


Micromeritics Instrument Corporation

Sample: C 0.45-B23Feb05Br 1198-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1198B.SMP

LP Analysis Time: 4/19/2007 10:48:00AM
HP Analysis Time: 4/19/2007 11:50:14AM
Report Time: 4/19/2007 11:50:17AM

Sample Weight: 2.1876 g
Correction Type: None
Show Neg. Int: No



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APPENDIX G

MERCURY INTRUSION POROSIMETRY OF 0.35 BR CONCRETE

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM	Sample Weight: 2.3612 g
HP Analysis Time: 4/19/2007 2:16:16PM	Correction Type: None
Report Time: 4/19/2007 2:17:34PM	Show Neg. Int: No

Summary Report

Penetrometer parameters

Penetrometer: 850 - (07) 5 Bulb, 0.392 Stem, Solid

Pen. Constant:	11.117 µL/pF	Pen. Weight:	56.9824 g
Stem Volume:	0.3920 mL	Max. Head Pressure:	4.4500 psia
Pen. Volume:	6.0452 mL	Assembly Weight:	125.5811 g

Hg Parameters

Adv. Contact Angle:	130.000 degrees	Rec. Contact Angle:	130.000 degrees
Hg Surface Tension:	485.000 dynes/cm	Hg Density:	13.5335 g/mL

Low Pressure:

Evacuation Pressure:	50 µmHg
Evacuation Time:	5 mins
Mercury Filling Pressure:	0.56 psia
Equilibration Time:	10 secs

High Pressure:

Equilibration Time: 10 secs

No Blank Correction

Intrusion Data Summary

Total Intrusion Volume =	0.0720 mL/g
Total Pore Area =	6.863 m²/g
Median Pore Diameter (Volume) =	0.4522 µm
Median Pore Diameter (Area) =	0.0059 µm
Average Pore Diameter (4V/A) =	0.0419 µm
Bulk Density at 0.56 psia =	2.0517 g/mL
Apparent (skeletal) Density =	2.4070 g/mL
Porosity =	14.7626 %
Stem Volume Used =	43 %

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
0.56	322.4848	0.0000	0.0000	0.000	0.000
0.80	226.5145	0.0013	0.0013	0.000	0.000
1.05	172.8499	0.0020	0.0007	0.000	0.000
2.03	89.1409	0.0040	0.0020	0.000	0.000
3.03	59.7489	0.0046	0.0006	0.000	0.000
4.02	44.9422	0.0051	0.0005	0.000	0.000
5.52	32.7474	0.0055	0.0005	0.000	0.000
7.02	25.7539	0.0059	0.0003	0.000	0.000
8.51	21.2445	0.0061	0.0003	0.000	0.000
10.50	17.2180	0.0064	0.0002	0.000	0.000
12.99	13.9196	0.0066	0.0003	0.000	0.000
15.98	11.3164	0.0072	0.0006	0.001	0.000
19.96	9.0600	0.0076	0.0004	0.001	0.000
23.01	7.8595	0.0079	0.0002	0.001	0.000
24.95	7.2490	0.0080	0.0002	0.001	0.000
29.98	6.0336	0.0086	0.0005	0.001	0.000
37.00	4.8888	0.0090	0.0004	0.002	0.000
46.42	3.8961	0.0100	0.0010	0.003	0.001
57.03	3.1712	0.0111	0.0011	0.004	0.001
71.43	2.5322	0.0127	0.0016	0.006	0.002
86.16	2.0993	0.0141	0.0015	0.009	0.003
112.04	1.6143	0.0166	0.0024	0.014	0.005
137.64	1.3140	0.0187	0.0021	0.020	0.006
172.93	1.0459	0.0216	0.0029	0.029	0.010
216.20	0.8365	0.0255	0.0038	0.046	0.016
265.57	0.6810	0.0293	0.0038	0.066	0.020
327.36	0.5525	0.0331	0.0038	0.090	0.025
416.61	0.4341	0.0364	0.0034	0.118	0.027
517.35	0.3496	0.0384	0.0020	0.138	0.020
637.47	0.2837	0.0399	0.0015	0.157	0.019
699.39	0.2586	0.0405	0.0006	0.166	0.009
797.95	0.2267	0.0413	0.0008	0.178	0.013
986.40	0.1834	0.0424	0.0012	0.201	0.022
1197.55	0.1510	0.0435	0.0011	0.227	0.026
1296.96	0.1395	0.0440	0.0005	0.241	0.014
1399.36	0.1292	0.0445	0.0005	0.257	0.015
1496.22	0.1209	0.0450	0.0005	0.273	0.016
1596.85	0.1133	0.0456	0.0005	0.291	0.018
1696.18	0.1066	0.0461	0.0005	0.310	0.019

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
1895.12	0.0954	0.0472	0.0011	0.353	0.043
2047.34	0.0883	0.0480	0.0008	0.389	0.036
2196.22	0.0824	0.0488	0.0008	0.428	0.039
2345.76	0.0771	0.0497	0.0009	0.472	0.044
2495.48	0.0725	0.0506	0.0009	0.520	0.049
2645.39	0.0684	0.0516	0.0009	0.573	0.052
2694.77	0.0671	0.0519	0.0003	0.591	0.018
2845.03	0.0636	0.0527	0.0009	0.645	0.054
2992.77	0.0604	0.0536	0.0008	0.698	0.053
3242.87	0.0558	0.0548	0.0013	0.786	0.088
3487.50	0.0519	0.0560	0.0011	0.869	0.083
3739.85	0.0484	0.0570	0.0010	0.949	0.080
3990.77	0.0453	0.0578	0.0009	1.024	0.075
4238.71	0.0427	0.0586	0.0008	1.092	0.069
4483.62	0.0403	0.0592	0.0006	1.152	0.060
4722.88	0.0383	0.0598	0.0006	1.211	0.058
4981.22	0.0363	0.0603	0.0005	1.267	0.057
5282.97	0.0342	0.0609	0.0005	1.328	0.060
5479.68	0.0330	0.0612	0.0003	1.367	0.039
5730.78	0.0316	0.0615	0.0004	1.411	0.044
5980.48	0.0302	0.0619	0.0003	1.454	0.043
6231.88	0.0290	0.0622	0.0003	1.495	0.042
6480.37	0.0279	0.0625	0.0003	1.535	0.040
6732.39	0.0269	0.0627	0.0003	1.575	0.040
6976.48	0.0259	0.0630	0.0002	1.611	0.037
7483.36	0.0242	0.0634	0.0004	1.678	0.066
7980.84	0.0227	0.0638	0.0004	1.743	0.065
8482.66	0.0213	0.0641	0.0003	1.802	0.059
8981.00	0.0201	0.0644	0.0003	1.858	0.057
9279.99	0.0195	0.0645	0.0002	1.890	0.032
9578.33	0.0189	0.0647	0.0002	1.923	0.033
10030.45	0.0180	0.0649	0.0002	1.969	0.045
10481.19	0.0173	0.0651	0.0002	2.012	0.044
10979.76	0.0165	0.0653	0.0002	2.056	0.044
11479.47	0.0158	0.0655	0.0002	2.099	0.042
11979.74	0.0151	0.0656	0.0002	2.140	0.041
12581.39	0.0144	0.0658	0.0002	2.185	0.045
13076.93	0.0138	0.0659	0.0001	2.223	0.038
13630.83	0.0133	0.0660	0.0001	2.262	0.040

Micromeritics Analytical Services — The Particle Testing Authority

Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m^2/g)	Incremental Pore Area (m^2/g)
13975.02	0.0129	0.0661	0.0001	2.289	0.027
14314.87	0.0126	0.0662	0.0001	2.314	0.025
14574.79	0.0124	0.0663	0.0001	2.334	0.020
14977.17	0.0121	0.0664	0.0001	2.364	0.030
15428.90	0.0117	0.0665	0.0001	2.396	0.032
15775.06	0.0115	0.0665	0.0001	2.424	0.028
16178.22	0.0112	0.0666	0.0001	2.454	0.030
16626.35	0.0109	0.0667	0.0001	2.486	0.033
16973.64	0.0107	0.0668	0.0001	2.510	0.024
17326.49	0.0104	0.0668	0.0001	2.534	0.024
17675.39	0.0102	0.0669	0.0001	2.561	0.027
18074.05	0.0100	0.0670	0.0001	2.592	0.031
18423.91	0.0098	0.0671	0.0001	2.619	0.027
18775.67	0.0096	0.0671	0.0001	2.646	0.026
19172.30	0.0094	0.0672	0.0001	2.676	0.030
19777.78	0.0091	0.0673	0.0001	2.715	0.039
20277.42	0.0089	0.0674	0.0001	2.757	0.042
20780.43	0.0087	0.0674	0.0000	2.779	0.022
21183.59	0.0085	0.0675	0.0001	2.809	0.030
21634.79	0.0084	0.0676	0.0001	2.836	0.027
22035.44	0.0082	0.0676	0.0001	2.866	0.030
22638.49	0.0080	0.0677	0.0001	2.906	0.041
23189.84	0.0078	0.0678	0.0001	2.937	0.030
23739.64	0.0076	0.0678	0.0001	2.969	0.032
24090.56	0.0075	0.0679	0.0001	3.000	0.032
24641.06	0.0073	0.0679	0.0001	3.030	0.029
25041.35	0.0072	0.0680	0.0001	3.062	0.032
25441.15	0.0071	0.0680	0.0000	3.088	0.026
25891.90	0.0070	0.0681	0.0001	3.121	0.033
26442.90	0.0068	0.0682	0.0001	3.158	0.037
26942.21	0.0067	0.0682	0.0000	3.180	0.023
27393.13	0.0066	0.0683	0.0001	3.216	0.036
27793.09	0.0065	0.0683	0.0001	3.248	0.032
28243.87	0.0064	0.0684	0.0001	3.286	0.038
28993.73	0.0062	0.0685	0.0001	3.339	0.053
29492.05	0.0061	0.0685	0.0000	3.359	0.020
29994.32	0.0060	0.0685	0.0001	3.398	0.039
30443.91	0.0059	0.0686	0.0001	3.432	0.034
30894.64	0.0059	0.0687	0.0001	3.473	0.041

Micromeritics Analytical Services — The Particle Testing Authority

Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No

Tabular Report

Pressure (psia)	Pore Diameter (μm)	Cumulative Pore Volume (mL/g)	Incremental Pore Volume (mL/g)	Cumulative Pore Area (m²/g)	Incremental Pore Area (m²/g)
31293.64	0.0058	0.0687	0.0000	3.503	0.030
31794.35	0.0057	0.0688	0.0001	3.541	0.038
32344.64	0.0056	0.0688	0.0001	3.586	0.045
32895.32	0.0055	0.0689	0.0001	3.634	0.048
33494.27	0.0054	0.0690	0.0001	3.682	0.048
33992.91	0.0053	0.0690	0.0000	3.717	0.035
34645.75	0.0052	0.0691	0.0001	3.780	0.063
35494.70	0.0051	0.0691	0.0001	3.829	0.048
36193.83	0.0050	0.0692	0.0001	3.901	0.072
36993.91	0.0049	0.0692	0.0000	3.906	0.005
37643.88	0.0048	0.0693	0.0001	3.991	0.085
38442.79	0.0047	0.0694	0.0001	4.058	0.067
39194.79	0.0046	0.0695	0.0001	4.120	0.062
39994.35	0.0045	0.0696	0.0001	4.193	0.073
40494.87	0.0045	0.0696	0.0001	4.253	0.060
40993.75	0.0044	0.0697	0.0001	4.311	0.058
42493.50	0.0043	0.0698	0.0001	4.403	0.092
43343.00	0.0042	0.0699	0.0001	4.504	0.101
43992.13	0.0041	0.0700	0.0001	4.586	0.081
44989.66	0.0040	0.0701	0.0001	4.689	0.104
46488.02	0.0039	0.0703	0.0002	4.847	0.158
47985.86	0.0038	0.0704	0.0001	4.970	0.123
49479.35	0.0037	0.0705	0.0002	5.134	0.164
50176.16	0.0036	0.0706	0.0001	5.259	0.125
52975.62	0.0034	0.0709	0.0003	5.572	0.314
54473.39	0.0033	0.0711	0.0002	5.794	0.222
55973.19	0.0032	0.0713	0.0002	6.076	0.282
57972.02	0.0031	0.0716	0.0003	6.430	0.355
59972.35	0.0030	0.0720	0.0003	6.863	0.432

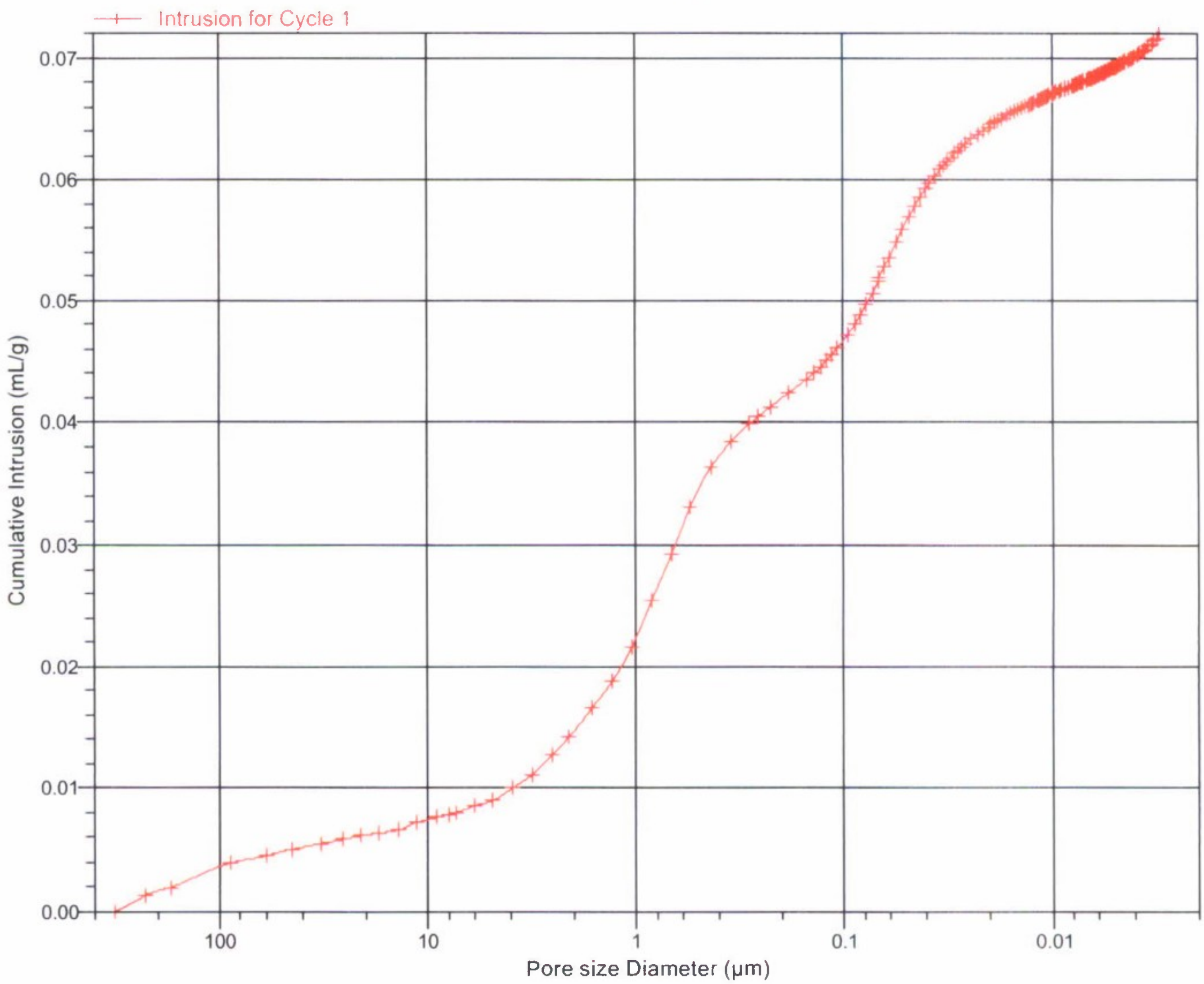
Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07	Serial: 454	Port: 2/2	Page 6

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time:	4/19/2007 12:25:36PM	Sample Weight:	2.3612 g
HP Analysis Time:	4/19/2007 2:16:16PM	Correction Type:	None
Report Time:	4/19/2007 2:17:34PM	Show Neg. Int:	No

Cumulative Intrusion vs Pore size

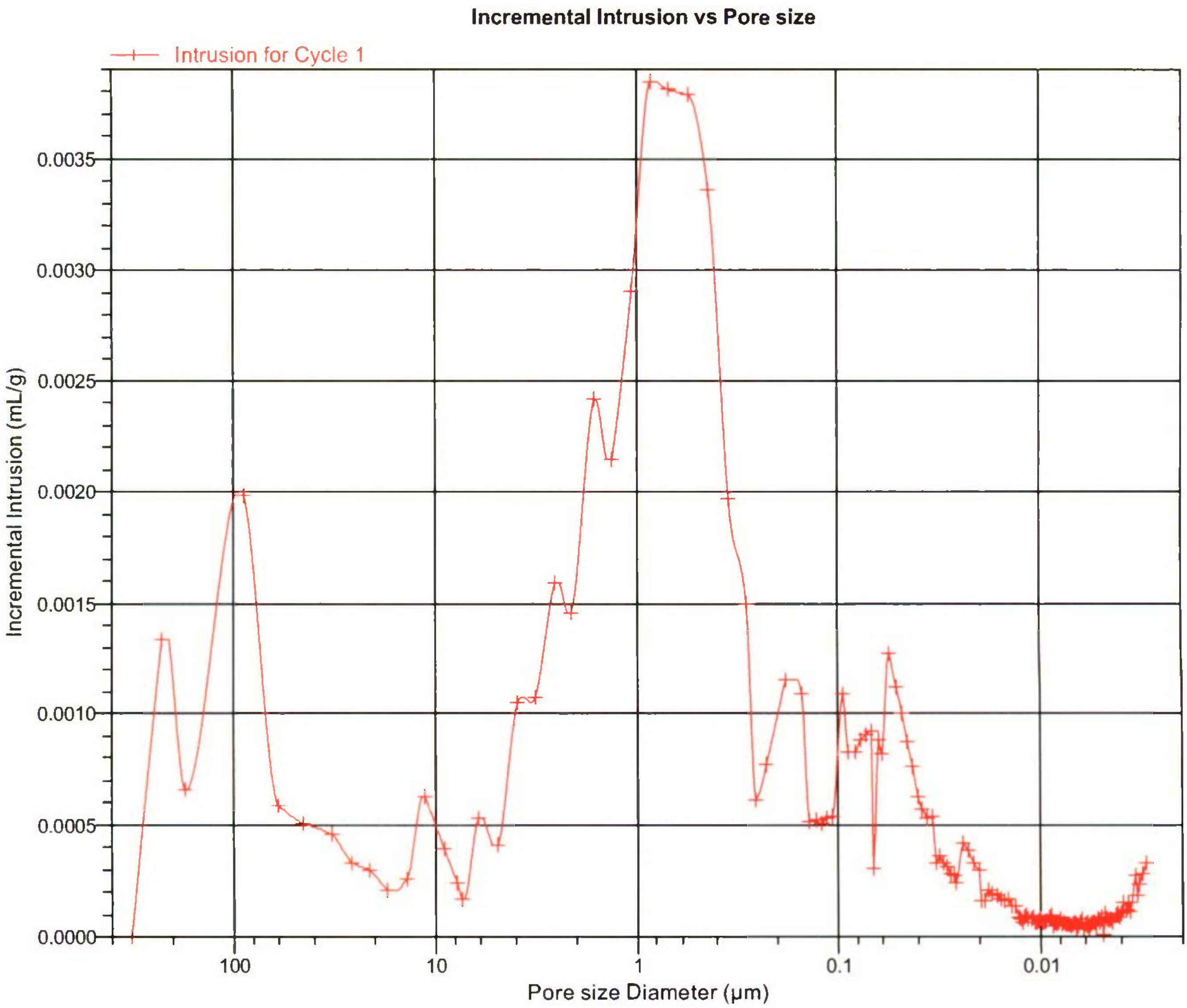


Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No



Micromeritics Analytical Services — The Particle Testing Authority

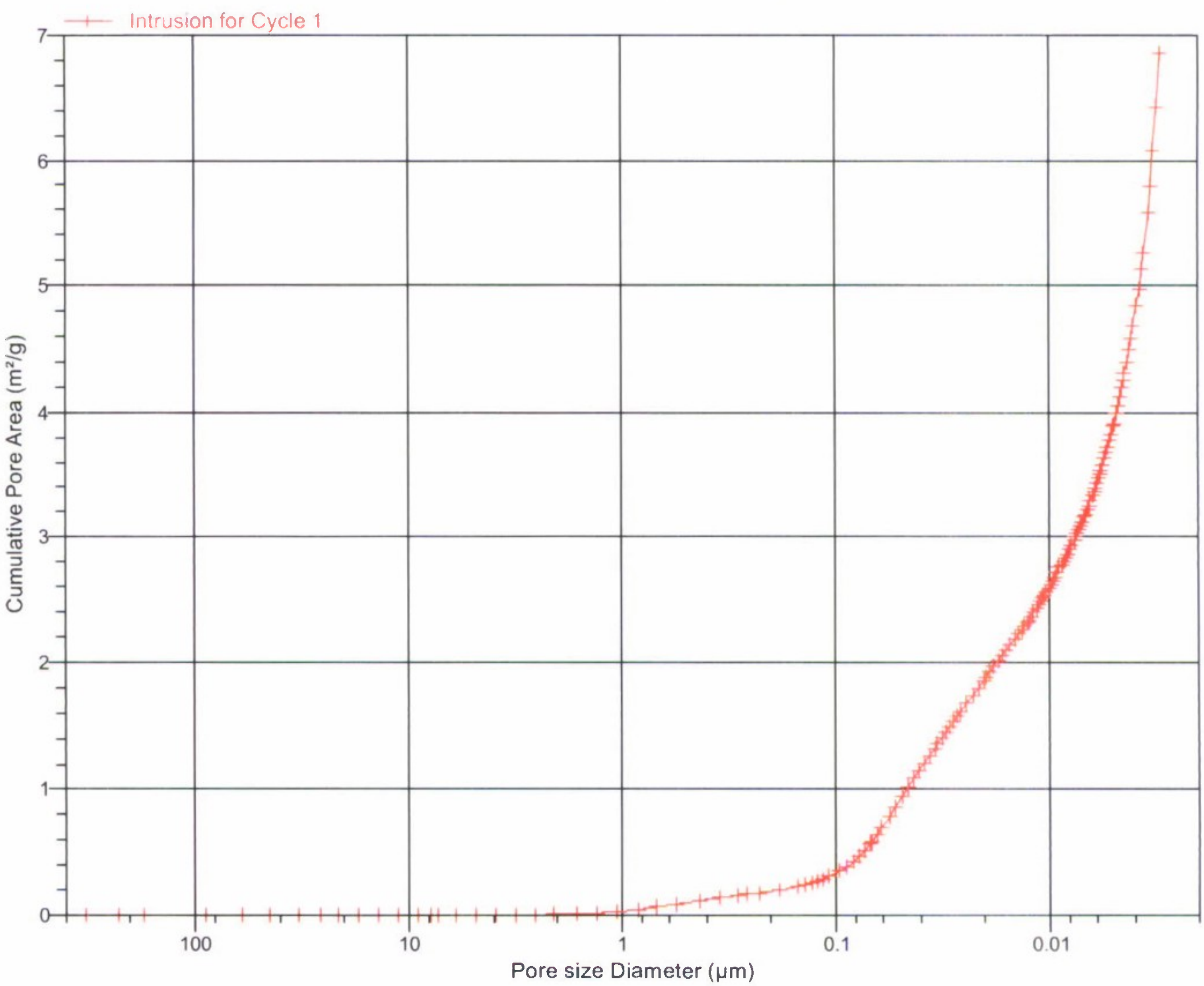
Micromeritics Instrument Corporation

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No

Cumulative Pore Area vs Pore size



Micromeritics Instrument Corporation

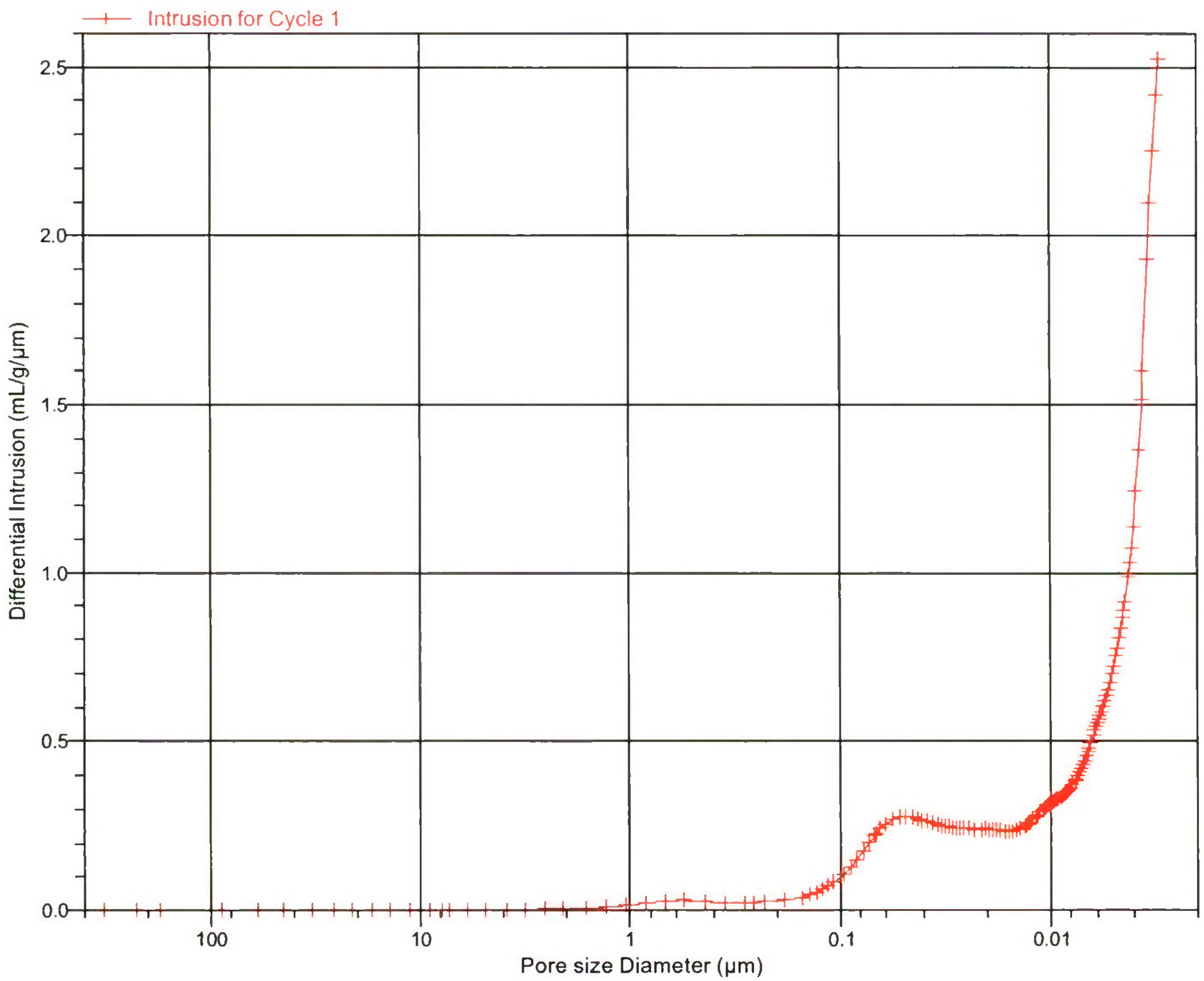
AutoPore IV 9500 V1.07 Serial: 454 Port: 2/2

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No

Differential Intrusion vs Pore size



Micromeritics Instrument Corporation

AutoPore IV 9500 V1.07 | Serial: 454 | Port: 2/2 |

Sample: C 0.35-A-7Apr05 Brushed 1202-2-454
Operator: Chris Brown
Submitter: Aberdeen Proving Grounds
File: C:\9500\DATA\2007\04APRIL\07-1202A.SMP

LP Analysis Time: 4/19/2007 12:25:36PM
HP Analysis Time: 4/19/2007 2:16:16PM
Report Time: 4/19/2007 2:17:34PM

Sample Weight: 2.3612 g
Correction Type: None
Show Neg. Int: No